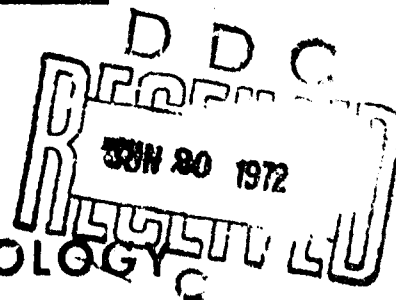


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## DOCUMENT CONTROL DATA - R &amp; D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate source)		2a. REPORT SECURITY CLASSIFICATION	
Air Force Institute of Technology, School of Systems and Logistics			
3. REPORT TITLE		2b. GROUP	
MEASUREMENT OF THE ATTITUDES OF OPERATIONAL UNIT MANAGERS TOWARD THE AIR FORCE INSPECTION AND READINESS EVALUATION PROGRAM			
4. DESCRIPTIVE NOTES (Type of report and inclusive dates)			
Thesis			
5. AUTHOR(S) (First name, middle initial, last name)			
Joseph D. Keotler (Major USAF) and Glenn E. Boren (Capt USAF)			
6. REPORT DATE		7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
28 January 1972		117	23
8a. CONTRACT OR GRANT NO.		9a. ORIGINATOR'S REPORT NUMBER(S)	
b. PROJECT NO.		SLSR-8-72A	
c.		9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
d.			
10. DISTRIBUTION STATEMENT			
STATEMENT A			
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY	
13. ABSTRACT			
<p>For better effectiveness, control and information systems should be understood and supported at all organizational levels. Assuming the Air Force Inspection and Readiness Evaluation Program to be a control and information system, this study samples attitudes of lower level Air Force managers (division level and below) toward the present system. Aerospace Defense Command and Strategic Air Command managers are surveyed. A Likert scale is used to obtain not only overall attitude scores, but also scores in critical areas defined by the authors as the relevancy, criticality, efficiency, effectiveness, and flexibility of the inspection system. Quantitative and qualitative results are presented.</p> <p><u>KEY WORDS:</u></p> <p>Attitudes Towards Inspections</p> <p>Inspections And Evaluations</p> <p>Air Force Inspection System</p> <p>Readiness Evaluations</p>			

MEASUREMENT OF THE ATTITUDES OF  
OPERATIONAL UNIT MANAGERS TOWARD THE  
AIR FORCE INSPECTION AND READINESS  
EVALUATION PROGRAM

Major Joseph D. Kestler  
Captain Glenn E. Boren

SLSR-8-72A

MEASUREMENT OF THE ATTITUDES OF OPERATIONAL UNIT  
MANAGERS TOWARD THE AIR FORCE INSPECTION  
AND READINESS EVALUATION PROGRAM

A Thesis

Presented to the Faculty of the School of Systems and Logistics  
of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Logistics Management

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January 1972

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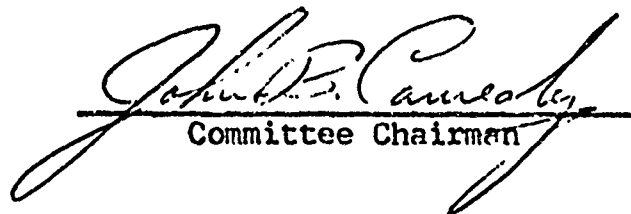
and

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and approved in an oral examination, has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT

Date: 28 January 1972

  
Committee Chairman

## TABLE OF CONTENTS

	Page
LIST OF TABLES . . . . .	v
 Chapter	
1. INTRODUCTION . . . . .	1
BACKGROUND . . . . .	5
PROBLEM STATEMENT . . . . .	11
SCOPE OF ANALYSIS . . . . .	12
OBJECTIVES AND SUB-OBJECTIVES . . . . .	14
RESEARCH QUESTIONS . . . . .	14
2. METHODOLOGY . . . . .	16
THE SAMPLE SURVEY TECHNIQUE . . . . .	16
DATA ANALYSIS AND STATISTICAL TECHNIQUE . . . . .	23
3. RESULTS OF ANALYSES AND ANSWERS TO RESEARCH QUESTIONS . . . . .	35
RESULTS OF ADC RESPONSE ANALYSIS . . . . .	35
RESULTS OF SAC RESPONSE ANALYSIS . . . . .	39
RESULTS OF ADC AND SAC COMPARATIVE ANALYSIS . . . . .	43
ANSWERS TO RESEARCH QUESTIONS . . . . .	46
4. SOME QUALITATIVE INFERENCES OF THE SURVEY, SUMMARY OF FINAL CONCLUSIONS, AND IMPLICATIONS FOR FUTURE RESEARCH . . . . .	50
QUALITATIVE INFERENCES . . . . .	50
SUMMARY OF FINAL CONCLUSIONS . . . . .	54
IMPLICATIONS FOR FUTURE RESEARCH . . . . .	57

Chapter	Page
APPENDIXES . . . . .	59
BIBLIOGRAPHY . . . . .	108



# LIST OF TABLES

Table	Page
1. ADC Job Positions Surveyed and Responses Returned . . . . .	19
2. SAC Job Positions Surveyed and Responses Returned . . . . .	20
3. Attitude Areas and Questionnaire Reference List . . . . .	27
4. Array of Area and Total Scores from Research Questionnaires Returned by ADC Unit Managers . . . . .	28
5. Array of Area and Total Scores from Research Questionnaires Returned by SAC Unit Managers . . . . .	29
6. Example of a Contingency Table for Two- Sample Median Test . . . . .	33
7. Results of Sign Test for ADC Sample . . . . .	36
8. Results of Sign Test for SAC Sample . . . . .	40

## Chapter 1

### INTRODUCTION

The Air Force Inspection and Readiness Evaluation System is an integral part of the Air Force management environment. The stated objective of the system as published in Air Force Regulation 123-1 is to provide the Secretary of the Air Force, the Chief of Staff, United States Air Force, and the major commanders:

1. A capability to maintain continuing surveillance over the status of readiness within the commands.
2. A measure of the effectiveness and efficiency of management systems.
3. Factual information upon which to base action when a management system is not achieving maximum effectiveness and economy.<sup>1</sup>

The inspection system is a vital control and information mechanism used in modern aerospace management. It is purposed to provide factual evaluations of the efficiency and effectiveness of not only plans and policies, but also of normal and wartime operations and procedures.<sup>2</sup> Elements

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<sup>1</sup>U.S. Department of the Air Force, Headquarters U.S. Air Force The Inspection System, Air Force Regulation 123-1 (Washington: Government Printing Office, 6 March 1970), p. 2.

<sup>2</sup>Ibid.

of the inspection system exist at all levels of Air Force management, from Headquarters United States Air Force down through the wing and squadron levels. "The inspection system extends into every field of Air Force affairs."<sup>3</sup> A comprehensive but by no means exhaustive list of specific areas with which inspections are concerned includes:<sup>4</sup>

1. The adequacy and preparedness of the Air Force to carry out its assigned role as an agency of national defense.

2. The state of training, readiness, combat capability, and logistical support; the ability of units and individuals to perform their missions and functions effectively and economically.

3. Discipline, morale, health, and welfare of units and individuals.

4. Air Force programming, including the computation of requirements.

5. The management of research and development to assure that the needs of operating commands are fulfilled promptly, efficiently, and economically.

6. The effectiveness, safety, and economy of practices and procedures, to include identifying those that merit recognition or consideration for application to other Air Force organizations.

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<sup>3</sup>Ibid.

<sup>4</sup>Ibid.

7. The security programs of the Air Force.
8. Personnel administration, procurement, pay, classification, and assignment.
9. The economical and effective use of personnel, materiel, installations, facilities, and funds.
10. All aspects of procurement of materiel and services.
11. Compliance with laws and regulations, and the review of publications.
12. The storage, issue, repair, reclamation, and disposal of materiel.
13. The administration of appropriated and nonappropriated funds and activities supported by these funds.
14. Public relations.
15. The adequacy and effectiveness of organizational structure. Except as authorized the major command inspection function is centralized at the major command level. However, ". . . all functions and activities of a wing, base, or comparable command are subject to inspection by any higher echelon."<sup>5</sup>

As can be readily concluded from the above description of the pervasive scope of the intent and operation of the inspection system, many people at all levels of the Air Force organization are concerned with and affected by

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<sup>5</sup>Ibid., p. 3.

the system's operation and findings. The managers and subordinates at the lower operating levels, however, are the ones most often and directly affected. These lower operating agencies are the organizational elements whose performance is most often evaluated, and it is the managers of these agencies who must implement any changes necessitated by the results of inspections.

The number of manhours spent each year in support of the Air Force inspection system is enormous. These manhours include not only the time spent by inspectors in their actual on-site inspecting, but also include the time spent in precoordinating inspection team visits, in unit activities of preparing for known or suspected inspection visits, in administrative preparation of inspection findings reports, and in the answering of and correction of discrepancies found and reported during inspections. In some cases follow-up inspections are even required to assure compliance.

An effective and contributing control and information system must have the understanding and support of all the members of the organization which it is designed to serve. This study is an attempt to measure and report the degree to which the Air Force Inspection and Readiness Evaluation System is understood and supported by the unit managers of its operational organizations. The authors have assumed that this understanding and support is reflected in the attitudes of the managers toward the present system.

## BACKGROUND

Despite the rapid growth in the breadth and depth of military technology in the past two decades and the tremendous increase in the sophistication of the weapons systems employed by military managers, the literature concerning military management techniques has not dealt with the subject of the inspection and evaluation programs from a behavioral or attitudinal standpoint. Though there have been countless volumes written on the subject of improved military control systems and integrated information systems, especially in the area of weapon system management concepts; none of these works have examined the human side of the inspection and evaluation system. Of three studies completed at the Air Command and Staff College dealing directly with the inspection and evaluation programs of operational commands, only the one by Kelley even hinted at the possible human ramifications connected with these programs.<sup>6</sup> All three of these studies were mainly concerned with the ability of the inspection and evaluation system to produce and transmit control information to higher echelons. Each study concluded the existence of duplications and inadequacies in the system.

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<sup>6</sup>Major Carl S. Kelley, "An Analysis of Major Command Inspection and Evaluation Systems" (unpublished thesis, Air Command and Staff College, 1969), from the Abstract.

Other studies dealing with elements of control and information systems, such as budgeting, financial management, cost control, project and systems management concepts, information processing, and data automation are quite prevalent. As will be illustrated, the present Air Force Inspection and Evaluation Programs are an integral part of both the control and information systems, yet an attitudinal approach which could shed light on some of the problems has not been attempted.

Inspection and Evaluation as Parts of  
Control and Information Systems

From a functional standpoint Koontz and O'Donnell define control as ". . . the measurement and correction of the performance of subordinates in order to make sure that enterprise objectives and the plans devised to attain them are accomplished."<sup>7</sup> Inspections and evaluations definitely are intended to measure performance. From a systems point of view, Johnson, Kast, and Rosensweig have defined control as ". . . that function of the system which provides direction in conformance to the plan, or in other words, the maintenance of variations from system objectives within allowable limits."<sup>8</sup> They have further elaborated on the

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<sup>7</sup>Harold Koontz and C. O'Donnell, Principles of Management (4th ed.; New York: McGraw-Hill Book Co., 1968), p. 639.

<sup>8</sup>R. A. Johnson, F. E. Kast, and J. E. Rosensweig, The Theory and Management of Systems (New York: McGraw-Hill Book Co., 1963), p. 58.

elements of all control systems, which paraphrased and explained are:

1. A controlled characteristic which may be the output of the system.

2. A method for measuring the characteristic which involves the measurement of performance.

3. A control group which compares measured data with planned performance and directs a correcting mechanism in response to need.

4. An activating group which is capable of bringing about a change in the operating system.<sup>9</sup>

All descriptions of control and control systems either imply or state the same basic steps, sub-processes, or sub-systems, mainly:

1. Establishment of organizational objectives.

2. Creation of standards of performance.

3. Measurement of actual performance.

4. Comparison of actual performance to standards.

5. Initiation of necessary corrective action.

Within the Air Force portion of the National Defense System the control process operates via the same steps listed above. The highest level goals or objectives are established by duly-elected leadership in light of the socio-economic-political environment of the times. These objectives are

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<sup>9</sup>Ibid.



then translated and assigned as "missions" to operational Air Force units. Air Force directives, regulations, and procedures establish the expected standards of performance. Inspections and evaluations measure performance and compare it to the standards. Unit commanders and other unit managers then take the necessary actions. Thus, inspections and evaluations are the vital link in the control system.

Inspections and evaluations are also a critical part of the management information systems closely connected with the control systems. According to Solomon any systematic process for providing information is an information system.<sup>10</sup> He further categorizes the information these systems are required to provide as "Strategic Planning Information" pertaining to the setting of objectives, "Management Control Information" which integrates resource utilization, and "Operational Information" which pertains to the efficiency and effectiveness of daily activities.<sup>11</sup> Inspections are important to information systems in that they verify the data carried by the system and validate the inputting procedures.

#### Importance of the Problem Area

This study has importance and conceivably wide impact by virtue of the large numbers of operating units

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<sup>10</sup>Martin B. Solomon, cited by Joseph L. Massie, "Information Systems and Computers," Essentials of Management (2nd ed.; Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1971), p. 177.

<sup>11</sup>Ibid., p. 178.

and hundreds of thousands of personnel affected yearly by inspections and evaluations. If the results of the study were extended to all of the Aerospace Defense Command, the units concerned would be well over 100 and the affected personnel would be well over 100,000. If the results of the study were next logically extended to the Tactical and Strategic Air Commands, whose units must also undergo yearly inspections and evaluations, then the units and personnel affected become impressively larger and larger. Therefore, the sheer numbers of units and people affected lend importance to a study of this nature.

A second area of importance is the cost of the inspections and evaluations themselves. If only the elemental costs of salaries, per diem, and transportation are considered, inspection and evaluation costs may reach \$50,000 to \$60,000 per inspection. These figures do not include the costs of live or simulated exercises required by operational evaluations. A General Accounting Office study of 81 Management Evaluation Groups within the Department of Defense disclosed budgets totaling over \$54,000,000 in 1968.<sup>12</sup> In times of ever-tightening military budgets and amidst cries for more efficient dollar usage by military managers, any study which may aid in the generation of cost-effective operational alternatives is valuable.

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<sup>12</sup>U.S. Comptroller General, Need for Better Coordination Among, and Guidance of, Management Evaluation Groups in the Department of Defense (report to the Congress of GAO study, Report #B-132900, January 2, 1970) p. 10.

A final important consideration is the recommendation for Defense Department reorganization under the Blue Ribbon Panel Report.<sup>13</sup> The recommendations in this context would place the Inspection Services under a Deputy Secretary of Defense for Evaluation. The General Accounting Office study cited earlier also recommended realignment of inspection and evaluation activities, since overlapping and repetitive efforts tended ". . . to unnecessarily disrupt operations and adversely affect morale in the organizations involved."<sup>14</sup> A study which would survey the attitudes of the managers in the field who are directly affected by inspections and use the data gathered would be helpful during this period of reorganization.

Cleland and King<sup>15</sup> list the prerequisites of effective control systems. Koontz and O'Donnell<sup>16</sup> also confirm these same characteristics as requirements of adequate control. In essence, the principles which these writers imply are that controls should:

1. Be understood by those who use it and obtain data from it.

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<sup>13</sup>U.S. Blue Ribbon Defense Panel Report, report to the President and the Secretary of Defense on the Department of Defense (Washington: July 1, 1970) p. 3. (Mimeographed copy).

<sup>14</sup>Comptroller General Report, op. cit., p. 18.

<sup>15</sup>David I. Cleland and W. R. King, Systems Analysis and Project Management (New York: McGraw-Hill Book Co., 1968), pp. 246-247.

<sup>16</sup>Koontz and O'Donnell, op. cit., pp. 645-647.

2. Be relative to the organization's functions.
3. Be timely in measuring deviations.
4. Be economical; that is, worth the expense.
5. Be flexible enough to adapt to a changing environment.
6. Indicate the nature of necessary corrective action.
7. Be objective, in that they are definite, in a clear and positive language.
8. Point up exceptions at the critical points.

An attitude survey of the nature of this study should give a representative indication of the attitudes of unit managers toward the Air Force system of inspection and evaluation in light of the prerequisites just listed above. It should be possible to detect either a positive or negative attitude toward the present system.

#### PROBLEM STATEMENT

The Inspector General (IG) of the Air Force has expressed a concern that managers within the commands are not using the management tools and data provided by the inspection of their own units and the inspections of other units within the same command.<sup>17</sup> The IG has cautioned inspectors and inspection teams to place continued emphasis

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<sup>17</sup>"The Inspector's Section," TIG Brief, June 5, 1970, p. 4.

on pre-inspection preparation in order to provide better inspection data and prevent unnecessary duplication.<sup>18</sup> The problem is that no studies have been conducted to determine the attitudes of the unit managers toward the conduct of and the data generated by these inspections and readiness evaluations.

### SCOPE OF ANALYSIS

In measuring the attitudes of unit managers toward the Air Force Inspection and Readiness Evaluation System, this study has been limited to unit managers in the Aerospace Defense Command (ADC) and the Strategic Air Command (SAC). Both of these commands are headquartered within the Continental United States, and are operational commands actively engaged in flying and flying support.

The use of the term "unit manager" as defined by the authors also limits the study to an investigation of attitudes at or below the division level. For the purposes of this study an ADC unit manager is defined as an individual directly responsible for the management of the resources necessary to allow a Division Commander to conduct an air battle. This will include Semi Automatic Ground Environment (SAGE) Direction Center Chiefs, Directors of Maintenance, Fighter Squadron Commanders, Radar Site Commanders, and

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<sup>18</sup>"The Inspector's Section," TIG Brief, February 12, 1971, p. 2.

Fighter Squadron Maintenance Officers. Analogous to the definition used in connection with ADC unit managers, a SAC "unit manager" is defined as an individual directly responsible for the management of the resources necessary to allow a Division Commander to conduct his portion of the battle plan. In this sense, SAC unit managers include Operations Chiefs, Directors of Maintenance, Bomb Wing Commanders, Bomb Squadron Commanders, Command and Control Center Chiefs, and Maintenance Squadron Officers.

The study was further limited to those areas directly related to the operational aspects of the ADC and SAC missions. This includes the areas of operations, maintenance, and supply. It was felt that the inclusion of indirect support areas such as civil engineering, the chaplain, and other base services functions would bias the sample due to the differing frequency and nature of the inspections to which these activities are subject. The SAC missile units were also excluded from the study, since there is no equivalent counterpart within the ADC organization.

In relating the findings of this study to potential problems in other operational commands one additional factor must be considered. The mission of ADC is to provide resources to the North American Air Defense Command (NORAD). This puts the ADC units under the operational control of NORAD which makes these units subject not only to ADC inspections but also to the inspections of NORAD.

## OBJECTIVES AND SUB-OBJECTIVES

### Objectives

The overall objective of this thesis is to analyze the attitudes of operational unit managers in the Aerospace Defense Command and Strategic Air Command toward the present Air Force Inspection and Readiness Evaluation System.

### Sub-Objectives

In order to accomplish the overall objective the following sub-objectives are used:

1. Measure the attitudes of the operational unit managers toward the present Air Force Inspection and Readiness Evaluation System.
2. Determine in which areas there exists a positive (receptive) attitude toward the present system, and in which areas there exists a negative (resistant) attitude.
3. Determine if the overall attitude of the operational unit managers is positive or negative.

## RESEARCH QUESTIONS

In order to accomplish the above objective and sub-objectives this study is addressed to answering the following research questions.

### Research Question Number One

In which areas of the present Air Force Inspection and Readiness Evaluation System are the attitudes of the operational unit managers positive?

Research Question Number Two

In which areas of the present Air Force Inspection and Readiness Evaluation System are the attitudes of the operational unit managers negative?

Research Question Number Three

What is the overall attitude of the operational unit managers toward the present Air Force Inspection and Readiness Evaluation System?

Research Question Number Four

Is there a significant difference in the attitudes of operational unit managers in SAC as opposed to operational unit managers in ADC?



## Chapter 2

### METHODOLOGY

In the preceding chapter the authors have defined the problem, as they view it. It is basically one of attempting to measure and report the attitudes of managers at the operating level toward a current organizational policy and management technique. Having adequately defined, subdivided, and framed the problem, the steps toward a research solution used by the authors was as follows:

1. Identify the population to be surveyed.
2. Sample the population via an appropriate survey instrument and sampling technique.
3. Analyze the data collected by use of appropriate statistical tests.
4. Infer answers to the research questions from the results of the statistical testing.

The approach to each of these steps is described in detail in the sections of this chapter.

### THE SAMPLE SURVEY TECHNIQUE

#### Nature and Sources of Data

The data used in this study relating to the attitudes of unit managers in the Aerospace Defense Command (ADC) and Strategic Air Command (SAC) toward the Air Force Inspection and Readiness Evaluation System was collected

from a sample of unit managers at and below the air division level within the two commands. For those readers not familiar with the Air Force organization structure, this level could be considered analogous to lower-middle and lower management levels in a business organization. It is the operating level. Attitude data was solicited by the use of a three part questionnaire mailed to selected unit managers. The construction and intent of the questionnaire is described in detail in the next section of this chapter.

Once the term "unit manager" had been defined and the scope of the study had been appropriately limited, the total population eligible to be sampled became all unit managers in ADC and SAC working in the areas of operations, maintenance, and supply. In order to answer Research Question Four, there were considered to be two populations, ADC unit managers and SAC unit managers. A list of job positions eligible to be surveyed was built, insuring the inclusion of jobs at the division, wing, and squadron levels. The selection of a specific division, wing, or squadron position for participation in the survey was completely random. Eligible organizations and job positions were numbered in sequence. The organization and job position were then selected by matching numbers from a computer generated random number table. The sampling process was considered to be one of multistage random sampling.<sup>1</sup> This

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<sup>1</sup>Russel L. Ackoff, The Design of Social Research (Chicago: The University of Chicago Press, 1953), p. 103.

form of random sampling was selected for a number of reasons. It provided a geographically dispersed sample not concentrated in any one Numbered Air Force or Air Defense Region. It provided the best method available to obtain a varying background of experience in the managers surveyed. Finally, this form of sampling guarded against the sample being biased by concentrated returns from organizations which had just recently been inspected or evaluated and having had a particularly good or bad experience with the inspection system. Table 1 and Table 2 array the job positions from which responses were solicited and returned at each level within the two commands surveyed. Table 1 contains ADC survey data. Table 2 contains the data on the SAC surveys mailed and returned.

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As can be seen in Table 1 and Table 2, the samples were weighted more heavily toward the wing and squadron levels. This was done since these levels receive the heaviest attention during operational inspections. Individuals were not identified nor were specific organizations, only the job positions. The questionnaires were mailed to these positions on an official basis through the Air Force Institute of Technology, School of Systems and Logistics.

#### Data Collection Technique

Prior to mailing the questionnaires to the selected unit manager job positions, a pre-test of the questionnaire was conducted. Members of the Graduate Logistics Management

Table 1

ADC Job Positions Surveyed  
and Responses Returned

Job position title	Level	Number mailed	Number returned
Deputy for Operations	Division	3	1
Deputy for Materiel	Division	3	3
Fighter Wing Commander	Wing	3	3
Deputy for Operations	Wing	3	1
Deputy for Materiel	Wing	3	3
Chief of Operations/ Training	Wing/Division <sup>b</sup>	3	1
Chief of Scheduling	Wing/Division <sup>b</sup>	3	1
Chief of Standardiza- tion	Wing/Division <sup>b</sup>	3	1
Direction Center Chief	Wing/Division <sup>b</sup>	3	2
Fighter Squadron Commander	Squadron	3	2
Radar Squadron Commander	Squadron	3	2
BUIC Site Commander	Squadron/ Group <sup>b</sup>	3	3
Field Maintenance Commander	Squadron	3	3
Organizational Mainte- nance COa	Squadron	3	3
Avionics Mainte- nance COa	Squadron	3	3
Total		45	32

<sup>a</sup>Commander.<sup>b</sup>Co-located positions in ADC organization structure.

Table 2

SAC Job Positions Surveyed  
and Responses Returned

Job position title	Level	Number mailed	Number returned
Deputy for Operations	Division	3	1
Deputy for Materiel	Division	3	1
Bomb Wing Commander	Wing	3	3
Deputy for Operations	Wing	3	2
Deputy for Materiel	Wing	3	3
Chief of Operations/ Training	Wing	3	2
Chief of Scheduling	Wing	3	3
Chief of Standardiza- tion	Wing	3	2
Chief of Control Division	Wing	3	0
Bomb Squadron Commander	Squadron	3	3
Refueling Squadron Commander	Squadron	3	3
Munitions Mainte- nance CO <sup>a</sup>	Squadron	3	2
Field Maintenance Commander	Squadron	3	2
Organizational Mainte- nance CO <sup>a</sup>	Squadron	3	3
Avionics Maintenance CO <sup>a</sup>	Squadron	3	2
Total		45	32

<sup>a</sup>Commander.

Class of the School of Systems and Logistics who had held job positions similar to those listed in Tables 1 and 2 were asked to complete the questionnaire using only the information supplied in the proposed cover letter and instructions. The purpose of the pre-test was to assure the clarity of the directions, understandability of the questions, relevancy of the available responses, and amount of time required for completion. The pre-test indicated no anticipated problems with either the survey directions or the questions. The data from the pre-test was used for the purpose of improving and finalizing the form of the questionnaire and was not used in the final results of the study. A copy of the final questionnaire and cover letter are included in Appendix A to this thesis.

Section I of the questionnaire provided biographical data which allowed categorization of the respondents into the levels of assignment. The other biographical data relating to present grade, authorized grade of present UDL position, AFSC, and length of time the individual had held his present or similar jobs was intended as an aid in the evaluation of results and to assure that the respondent met the requirements of the term "unit manager," as outlined in the scope of this study.

Section II of the questionnaire provided the data on the attitudes of the unit managers toward the present Air Force Inspection and Readiness Evaluation System which was needed to answer the research questions. This section

consisted of 26 positive stem statements concerning the present Air Force Inspection and Readiness Evaluation System. These statements were designed to measure the attitudes of managers in the areas of the five prerequisites of adequate and effective control systems in addition to the overall attitudes toward the system. The five prerequisite elements selected by the authors through a study of the literature were: relevancy, criticality, efficiency, effectiveness, and flexibility. Each statement was designed to apply to only one of the prerequisites or to an overall attitude area designated by the authors as a general area. Several statements on the survey questionnaire applied to each prerequisite and several statements applied to the general attitude area.

For each statement, the respondents were given a choice of seven "Likert type" responses, ranging from "strongly agree with the statement" to "strongly disagree with the statement." The midpoint of the scale was designated "neutral" and was assumed to be an indication of neither a positive nor a negative attitude toward the statement. Those responses falling above the midpoint, in the "agree" area, were considered to be reflective of positive attitudes. Those responses falling below the midpoint, in the "disagree" area, were considered to be reflective of negative attitudes toward the statement. Scale values from one to seven were assigned for scoring purposes such that one corresponded to strong disagreement,

while seven corresponded to strong agreement. Response values were summed over all applicable statements to arrive at a score for each area of interest and summed over all statements to arrive at an overall score. These scores, as explained in the next section, were then used to statistically test for the significance of the attitudes in order to answer the research questions. The ADC and SAC responses were scored separately. Results were compiled for each command separately. Scale values did not appear on the questionnaires mailed to the unit managers.

Section III of the questionnaire was designed to provide each respondent with an opportunity to make additional comments about the present Air Force Inspection and Readiness Evaluation System which he felt necessary or more explanatory of his feelings. The comments in this section provided insights needed for the qualitative evaluation of the data gathered in Section II.

## DATA ANALYSIS AND STATISTICAL TECHNIQUE

### Assumption of Ordinal Scale of Measurement

There exists some degree of disagreement among established researchers as to the measurement scale which may be applied to "Likert type" attitude scale data. In his correlation study of managerial attitudes versus managerial performance, Lyman Porter assumed interval



scaling for his Likert scale and calculated mean scores.<sup>2</sup> However, Selltiz has stated that a disadvantage of "Likert type" scales is that only ordinal scaling at best can be claimed.<sup>3</sup> Most researchers do agree that in order to assume better than ordinal scaling for "Likert type" attitude scales, that the distances between possible responses must appear to be equal to the respondents.<sup>4</sup>

Because of the sensitive nature of the study (attitudes toward current policies and procedures), the authors did not wish to assume more than ordinal scaling. In other words, to some respondents the distance from a "neutral" response to a "tend to agree" response may be somewhat different than that distance from a "tend to agree" response to an "agree" response. This difference in scale value interpretation may be due to differences in background, experience, present duty position, or for any number of reasons; but, as long as the difference does exist, ordinal scaling is the most appropriate assumption. Therefore, the attitude scores available from the questionnaire will be

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<sup>2</sup>Lyman W. Porter and E. E. Lawler, Managerial Attitudes and Performance (Homewood, Illinois: Richard D. Irwin, Inc., 1968), p. 198.

<sup>3</sup>Claire Selltiz and others, Research Methods in Social Relations (New York: Holt, Rinehart, and Winston, 1966), p. 369.

<sup>4</sup>Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Co., 1956), p. 26.

evaluated and analyzed using the "median" as the measure of central tendency.<sup>5</sup>

A seven-point Likert scale was used in this study as opposed to the more commonly used five-point scale. This technique was used in order to provide the respondents with a wider range of responses and reduce the tendency toward an overuse of the "neutral" response. This procedure was also used to reinforce the assumption that the "neutral" response was truly reflective of a "neutral" attitude.

### The Sign Test

The One-Sample Sign Test was used to test hypotheses relating to Research Questions One, Two, and Three. This test was chosen by the authors since it is one of the few tests which can be used to test hypotheses about the median of ordinally scaled data. The Sign Test forces a dichotomy of outcomes about the "hypothesized median," allowing the use of a binomial statistic.

Since the authors did not wish to assume that the scores would indicate a "positive" or "negative" attitude, the null hypothesis was that the attitudes of the unit managers in ADC and SAC were "neutral." However, the higher scores would tend to indicate more "positive" attitudes, while the lower scores would tend to indicate more "negative" attitudes. Using the seven-point "Likert type" scale with 26 statements, the total scores on a questionnaire could

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<sup>5</sup>Ibid., p. 25.

range from a minimum of 26 to a maximum of 182, with the median score being 104.

### Obtaining Critical Area Scores

In order to answer Research Questions One and Two, the categories or areas prerequisite to efficient and effective control systems cited earlier were used by the authors to obtain a score for each critical area which the authors wished to examine. These areas and associated definitions were developed by the authors from the background material on "control and information systems" discussed in Chapter 1. The critical prerequisite elements of adequate and effective control systems which were applied to the survey of attitudes of unit managers toward the Air Force Inspection and Readiness Evaluation System were:

- |                      |   |
|----------------------|---|
| <u>RELEVANCY</u>     | - The items or areas evaluated and/or inspected are relative to the assigned mission of the organization being inspected.   |
| <u>CRITICALITY</u>   | - The inspection and evaluation system is operated so as to measure and point out exceptions in those activities most critical to the accomplishment of the assigned mission. |
| <u>EFFICIENCY</u>    | - The inspection and evaluation system is operated in consideration of economical use of time, money, and manpower.   |
| <u>EFFECTIVENESS</u> | - The inspection and evaluation system clearly and consistently identifies areas of deviation and indicates the nature of necessary corrective actions.                       |

FLEXIBILITY - The inspection and evaluation system is adaptive to the changing operational environment and to the differences in the nature of assigned missions among various organizations.

Table 3 lists the areas, applicable question numbers from the questionnaire, and total number of applicable statements for each area.

Table 3  
Attitude Areas and Questionnaire  
Reference List

Area of interest	Applicable statement numbers	Total number of statements
Relevancy	1, 7, 18, 23	4
Criticality	14, 22, 25	3
Efficiency	9, 10, 11, 13, 15, 19	6
Effectiveness	3, 4, 5, 8, 12, 17	6
Flexibility	6, 26	2
General	2, 16, 20, 21, 24	5

The hypothesized median score for each area was established by multiplying the number of applicable statements in that area times the median scale score of 4. For example, the hypothesized median score for the "relevancy" area would be  $4 \times 4$ , or 16. To facilitate the statistical calculations using the Sign Test, the results of the scored questionnaires from ADC were arrayed in Table 4, and the scored responses from questionnaires returned from SAC were

arrayed in Table 5. The statistical calculations must be performed in order to show if the number of "positive" or "negative" scores are statistically significant. A five percent Significance Level was used, which placed 2.5 percent of the significance in each tail of the score distribution for a two-tailed test.

Table 4

Array of Area and Total Scores from Research Questionnaires Returned by ADC Unit Managers

Area of interest	Hypothesized median score	Number above median	Number equal median	Number below median
Relevancy	16	23	7	2
Criticality	12	12	0	20
Efficiency	24	19	3	10
Effectiveness	24	20	1	11
Flexibility	8	13	5	14
General	20	20	4	8
Total	104	21	1	10

Research Questions One and Two were tested with hypotheses using the values corresponding to areas of "Relevancy" through "General" from Tables 4 and 5. Research Question Three was tested using the "Total" score values from Tables 4 and 5. This method weighted the areas of "Efficiency" and "Effectiveness" most heavily in answering

Research Question Three by virtue of these areas having the highest number of applicable statements.

Table 5

Array of Area and Total Scores from Research  
Questionnaires Returned by SAC Unit Managers

Area of interest	Hypothesized median score	Number above median	Number equal median	Number below median
Relevancy	16	25	1	6
Criticality	12	13	7	12
Efficiency	24	11	4	17
Effectiveness	24	21	1	10
Flexibility	8	14	8	10
General	20	17	4	11
Total	104	21	1	10

Statements in the "General" category were statements on the questionnaire, which the authors felt did not fall clearly into only one of the other areas. They were included since they covered aspects very important to the conduct of inspections and evaluations.

Example Calculation of a "Relevancy" Score  
and Use of Sign Test of Hypothesis

Suppose that out of a sample of 55 questionnaires returned, the scores calculated for the "Relevancy" area yielded 34 scores below the hypothesized median of 16

(or  $B = 34$ ), 16 scores above the median (or  $A = 16$ ), and 5 scores equal to the median. These results would tend to indicate a negative attitude toward the "relevancy" of inspections and evaluations. However, before any assumptions can be made, this distribution of scores must be proven to be statistically significant. The procedure to be used is as follows:

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$H_0$ : Median = 16  
 $H_1$ : Median  $\neq$  16 (this infers that median is above or below 16)

Significance Level =  $5\% \div 2 = 2.5\% = .025$

A = random variable, # of scores above median; A = 1, 2, ..., 50

B = random variable, # of scores below median; B = 1, 2, ..., 50  
 (scores exactly equal to median are dropped from sample)

A and B follow a binomial distribution. Each has a theoretical probability of occurrence of one-half (0.5).

Required Probability:  $P(B = 34 | H_0) = P(A = 16 | H_0)$

This is the probability of having obtained 34 or more "negative" scores out of 50, and is equal to the probability of having obtained 16 or fewer "positive" scores out of 50.

From a Cumulative Binomial Statistical Table<sup>6</sup>  
 $P(A = 16 | H_0) = .0077$ .

Conclusion:

.0077 is less than significance level of .025  
 therefore, reject  $H_0$ , accept  $H_1$ .

This same procedure was followed for the scores in each area listed in Table 4 for ADC and Table 5 for SAC,

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<sup>6</sup>Chao, Lincoln L., Statistics: Methods and Analysis (New York: McGraw-Hill Book Co., 1969), p. 484.

including the total score. Had the probability of random occurrence been calculated to be greater than the level of significance, the null hypothesis ( $H_0$ ) could not have been rejected, and no conclusion as to attitude could be drawn.

Though tables are available for sample sizes of 50 or less for the Binomial Distribution, and the Normal Distribution can be used as an approximation for samples larger than 50; the authors calculated the probability for each test using a GE 615 computer. A copy of the computer routine is provided in Appendix D to the thesis. This method greatly facilitated the processing of data and provided improved accuracy.

#### The Median Test

Research Question Four calls for a comparison to be made between the results of the ADC attitude survey and the SAC attitude survey. Specifically, this research question asks if there is a significant difference in the attitudes of unit managers in the two commands toward the Air Force Inspection and Readiness Evaluation System. The authors elected to use the median test in testing hypotheses relating to Research Question Four.

Siegel<sup>7</sup> points out that the median test may be used to determine whether it is likely that two independent samples have been drawn from populations with the same

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<sup>7</sup>Ibid., p. 111.



median, or more generally, whether two independent groups differ in their central tendencies. The two samples need not be of the same size, and the test may be used whenever at least ordinally scaled data has been obtained.<sup>8</sup> The null hypothesis is that the medians of the two populations from which the samples have been drawn are equal; the alternative being that the two medians are either different (for two-tailed tests) or that one is higher than the other (for the one-tailed tests).

The test procedure, as used in this study, is quite straightforward. The ADC and SAC survey scores are combined and the combined median determined. The ADC and SAC scores are then dichotomized at the combined median (so many fall above, so many below), and cast into a 2 X 2 contingency table like Table 6.

The underlying assumption of the test is that if the two samples have been drawn from populations with equal medians, then it would be expected that about half of each group's scores would fall above the combined median and about half below. The probability of a given distribution of scores occurring, that is, of obtaining a set of numbers A, B, C, D as in Table 6, or a set even more extremely distributed, can be calculated statistically.

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<sup>8</sup>Ibid.

Table 6

Example of a Contingency Table  
for Two-sample Median Test

	ADC	SAC	Total
Number of scores above combined median	A	B	A + B
Number of scores below combined median	C	D	C + D
Total	A + C	B + D	N = n <sub>1</sub> + n <sub>2</sub>

If the combined sample size,  $n_1 + n_2$ , is sufficiently large, then scores falling exactly on the combined median may be dropped.<sup>9</sup> If  $n_1 + n_2$  is still between 20 and 40, and no expected cell size is less than 5, then a Chi Square statistic ( $\chi^2$ ) is used in conjunction with a table of Chi Square probabilities to determine the probability associated with the sample. The formula<sup>10</sup> used is:

$$\chi^2 = \frac{N(AD - BC - N/2)^2}{(A + B)(C + D)(A + C)(B + D)}$$

The probability associated with the calculated value of  $\chi^2$  with 1 degree of freedom can then be obtained from a Chi Square table. If this probability is less than the "significance level" established, then the null hypothesis may be rejected and the two samples assumed to have different

<sup>9</sup>Ibid., p. 112.

<sup>10</sup>Ibid., p. 109.

medians. If the probability is greater than the "significance level," then the null hypothesis of equal medians may not be rejected.

Research Question Four was tested by the above procedure using the scores of each area of concern (Relevancy, Criticality, Efficiency, Effectiveness, Flexibility, General) and using the overall scores. The results of the methodology and statistical testing which have been explained in this chapter are presented in the following chapter. All statistical calculations appear in Appendix C to this thesis.

## Chapter 3

### RESULTS OF ANALYSES AND ANSWERS TO RESEARCH QUESTIONS

The methodology and statistical analyses discussed in Chapter 2 were used for appropriate tests of hypotheses leading to statistical support for the answers to the research questions posed in Chapter 1. Each critical area score and an overall score were tested for both the SAC and ADC samples separately using the sign test. The general results of these 14 statistical tests are displayed in Table 7 and Table 8. Table 7 contains the results for the ADC sample and Table 8 gives the results for the SAC sample. These results were used as statistical support for answering Research Questions 1, 2, and 3. The samples were then combined and the median test used for comparative analyses between the SAC and ADC samples. Again, hypotheses were used to test each of the area attitude scores and to test the overall attitude scores. The calculations for all tests appear in Appendix C. The raw scores for both samples may also be found in Appendix C. Frequencies of responses to each survey statement, arranged by area, are in Appendix B.

#### RESULTS OF ADC RESPONSE ANALYSIS

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The results of the statistical tests of response score distributions for each attitude area and for the

overall attitudes of ADC unit managers are contained in this section.

### Relevancy Scores

The hypothesized median score for this area was 16. Of 32 ADC managers responding, 23 had cumulative scores above 16, seven had cumulative scores below 16, and two respondents had scores equal to 16. This indicated a positive attitude toward the "relevancy" of inspections and evaluations. Using the sign test to test this hypothesis, the authors concluded at the .05 significance level that the attitudes of ADC unit managers were positive toward the "relevancy" of inspections and evaluations.

Table 7  
Results of Sign Tests for ADC Sample

Area of interest	Number positive scores	Number negative scores	Probability	Indicated attitude		
				Pos	Neut	Neg
Relevancy	23	7	.0026	X		
Criticality	12	20	.1077			X
Efficiency	19	10	.0680	X		
Effectiveness	20	11	.0748	X		
Flexibility	13	14	.4999		X	
General	20	8	.0178	X		
Overall	21	10	.0354	X		

### Criticality Scores

The hypothesized median score for this area was 12. Of 32 ADC managers responding, 12 had cumulative scores above 12, 20 had cumulative scores below 12. This indicated a negative attitude toward the "criticality" of inspections and evaluations. Using the sign test to test this hypothesis, the authors could not conclude at the .05 significance level that the attitudes of ADC unit managers were, in fact, negative toward the "criticality" of inspections and evaluations. However, the attitudes could be concluded as negative at a .11 significance level.

### Efficiency Scores

The hypothesized median score for this area was 24. Of 32 ADC managers responding, 19 had cumulative scores above 24, 10 had cumulative scores below 24, and three respondents had scores equal to 24. This indicated a positive attitude toward the "efficiency" of inspections and evaluations. Using the sign test to test this hypothesis, the authors could not conclude at the .05 significance level that the attitudes of ADC unit managers were, in fact, positive toward the "efficiency" of inspections and evaluations. However, the attitudes could be concluded as positive at a .07 significance level.

### Effectiveness Scores

The hypothesized median score for this area was 24. Of 32 ADC managers responding, 20 had scores above 24, 11

had scores below 24, and one respondent had a score equal to 24. This indicated a positive attitude toward the "effectiveness" of inspections and evaluations. Using the sign test to test this hypothesis, the authors could not conclude at the .05 significance level that the attitudes of ADC unit managers were, in fact, positive toward the "effectiveness" of inspections and evaluations. However, the attitudes could be concluded as positive at a .08 significance level.

#### Flexibility Scores

The hypothesized median score for this area was eight. Of 32 ADC managers responding, 13 had scores above eight, 14 had scores below eight, and five respondents had scores equal to eight. This tended to indicate a neutral attitude toward the "flexibility" of inspections and evaluations. Since the hypothesis of a "neutral" attitude was the null hypothesis for the sign test, this attitude could never be statistically concluded. The null hypothesis may only be statistically rejected. In this case, the probability of the given distribution of neutral area scores was .4999, and the hypothesis of a "neutral" attitude could not be rejected.

#### General Scores

The hypothesized median score for these five statements was 20. Of 32 ADC managers responding, 20 had scores above 20, eight had scores below 20, and four respondents

had scores equal to 20. This indicated a positive attitude toward these general characteristics of inspections and evaluations. Using the sign test to test this hypothesis, the authors concluded at the .05 significance level that the attitudes of ADC unit managers were positive toward these general characteristics of inspections and evaluations.

#### Overall (Total) Scores

The hypothesized median for the total survey score was 104. Of 32 ADC managers responding, 21 had scores above 104, 10 had scores below 104, and one had a score equal to 104. This tended to indicate an overall positive attitude toward inspections and evaluations. Using the sign test to test this hypothesis, the authors concluded at the .05 significance level that the overall attitude of ADC unit managers toward inspections and evaluations was positive.

#### RESULTS OF SAC RESPONSE ANALYSIS

The results of the statistical tests of response score distributions for the overall attitudes of SAC unit managers are contained in this section.



Table 8  
Results of Sign Test for SAC Sample

Area of interest	Number positive responses	Number negative responses	Probability	Indicated attitude		
				Pos	Neut	Neg
Relevancy	25	6	.0004	X		
Criticality	13	12	.4999		X	
Efficiency	11	17	.1725			X
Effectiveness	21	10	.0354	X		
Flexibility	14	10	.2706	X		
General	17	11	.1725	X		
Total	21	10	.0354	X		

#### Relevancy Scores

The hypothesized median score for this area was 16. Of 32 SAC managers responding, 25 had cumulative scores above 16, six had cumulative scores below 16, and one respondent had a score equal to 16. This indicated a positive attitude toward the "relevancy" of inspections and evaluations. Using the sign test to test this hypothesis, the authors concluded at the .05 significance level that the attitude of SAC unit managers was positive toward the "relevancy" of inspections and evaluations.

#### Criticality Scores

The hypothesized median score for this area was 12. Of 32 SAC managers responding, 13 had cumulative scores

above 12, 12 had cumulative scores below 12, and seven respondents had a score equal to 12. This indicated a neutral attitude toward the "criticality" of inspections and evaluations. In using the sign test to test the hypothesis of indicated positive or negative attitudes the null hypothesis employed was that the attitudes were neutral. Therefore, it was not possible to reject the null hypothesis in this case. However, this does not statistically indicate that the attitude of SAC managers was neutral.

#### Efficiency Scores

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The hypothesized median score for this area was 24. Of 32 SAC managers responding, 11 had cumulative scores above 24, 17 had cumulative scores below 24, and four respondents had a score equal to 24. This indicated a negative attitude toward the "efficiency" of inspections and evaluations. Using the sign test to test this hypothesis, the authors could not conclude at the .05 significance level that the attitude of SAC unit managers was negative toward the "efficiency" of inspections and evaluations. However, if the significance level was raised to .18 one could be 82 percent sure that the attitude of SAC unit managers toward the "efficiency" of inspections and evaluations was negative.

#### Effectiveness Scores

The hypothesized median score for this area was 24. Of 32 SAC managers responding, 21 had cumulative scores above 24, 10 had cumulative scores below 24, and one

respondent had a score equal to 24. This indicated a positive attitude toward the "effectiveness" of inspections and evaluations. Using the sign test to test this hypothesis, the authors concluded at the .05 significance level that the attitude of SAC unit managers was positive toward the "effectiveness" of inspections and evaluations.

### Flexibility Scores

The hypothesized median score for this area was eight. Of 32 SAC managers responding, 14 had cumulative scores above eight, 10 had cumulative scores below eight, and eight respondents had a score equal to eight. This indicated a positive attitude toward the "flexibility" of inspections and evaluations. Using the sign test to test this hypothesis, the authors could not conclude at the .05 significance level that the attitude of SAC unit managers was positive toward the "flexibility" of inspections and evaluations.

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### General Scores

The hypothesized median score for this area was 20. Of 32 SAC managers responding, 17 had cumulative scores above 20, 11 had cumulative scores below 20, and four respondents had a score equal to 20. This indicated a positive attitude toward the "general" aspects of inspections and evaluations. Using the sign test to test this hypothesis, the authors could not conclude at the .05 significance level that the attitude of SAC unit managers was positive

toward the "general" aspects of inspections and evaluations. However, if the significance level was raised to .18 one could be 82 percent sure that the attitude of SAC unit managers toward the "general" aspects of inspections and evaluations was positive.

#### Overall Scores

The hypothesized median score for the combination of all areas was 104. Of 32 SAC managers responding, 21 had cumulative scores above 104, 10 had cumulative scores below 104, and one respondent had a score equal to 104. This indicated a positive "overall" attitude toward inspections and evaluations. Using the sign test to test this hypothesis, the authors concluded at the .05 significance level that the "overall" attitude of SAC unit managers was positive toward inspections and evaluations.

#### RESULTS OF ADC AND SAC COMPARATIVE ANALYSIS

This analysis, in support of Research Question Four, was conducted to test for a significant difference, if any, between the attitudes of ADC managers and SAC managers toward the Air Force Inspection and Readiness Evaluation System. Statistical tests were made using the combined attitude scores for each area of interest and for the overall scores.

### Relevancy Scores

A one-tailed median test was used to test the null hypothesis that the attitudes of ADC managers and SAC managers were the same toward the "relevancy" of inspections and evaluations. This hypothesis could not be rejected at the .10 significance level. Thus, it could not be concluded that the attitudes of managers in the two commands differed. In fact, the attitude scores of the two commands were so close in distribution pattern that this hypothesis could not have been rejected even at a .80 level of significance.

### Criticality Scores

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A one-tailed median test was used to test the null hypothesis that the attitudes of ADC managers and SAC managers were the same toward the "criticality" of inspections and evaluations. This hypothesis was rejected at the .10 significance level. The authors concluded that the attitudes of SAC managers were more positive than the attitudes of ADC managers toward the "criticality" of inspections and evaluations.

### Efficiency Scores

A one-tailed median test was used to test the null hypothesis that the attitudes of ADC managers and SAC managers were the same toward the "efficiency" of inspections and evaluations. This hypothesis was rejected at the .10 significance level. The authors concluded that the attitudes

of ADC managers were more positive than the attitudes of SAC managers toward the "efficiency" of inspections and evaluations.

#### Effectiveness Scores

A one-tailed median test was used to test the null hypothesis that the attitudes of ADC managers and SAC managers were the same toward the "effectiveness" of inspections and evaluations. This hypothesis could not be rejected at the .10 significance level. Thus, it could not be concluded that the attitudes of managers in the two commands differed. In fact, the attitude scores of the two commands were so close in distribution pattern that this hypothesis could not have been rejected even at a .80 level of significance with this sample size.

#### Flexibility Scores

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A one-tailed median test was used to test the null hypothesis that the attitudes of ADC managers and SAC managers were the same toward the "flexibility" of inspections and evaluations. This hypothesis could not be rejected at the .10 significance level. Thus, it could not be concluded that the attitudes of managers in the two commands differed. In fact, the attitude scores of the two commands were so nearly equal that this hypothesis could not have been rejected even at a .50 level of significance with this sample size.

### General Scores

A one-tailed median test was used to test the null hypothesis that the attitudes of ADC managers and SAC managers were the same toward some "general" characteristics of inspections and evaluations. This hypothesis could not be rejected at a .10 significance level. Thus, it could not be concluded that the attitudes of ADC managers and SAC managers differed toward these "general" characteristics of inspections and evaluations. In fact, the scores of the managers from the two commands were so close in this area, that the hypothesis could not have been rejected even at a .40 level of significance with this sample size.

### Overall (Total) Scores

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A one-tailed median test was used to test the null hypothesis that the overall attitudes of ADC managers and SAC managers were the same toward the Air Force Inspection and Readiness Evaluation System. This hypothesis could not be rejected at a .10 significance level. Thus, it could not be concluded that the overall attitudes of ADC managers and SAC managers differed. In fact, the distribution of attitude scores from the two commands were so similar that this hypothesis could not have been rejected even at a .50 level of significance with this sample size.

### ANSWERS TO RESEARCH QUESTIONS

The answers to the four research questions presented in this section were developed from the quantitative analysis

of the scored sample surveys. The answers are supported by the results of the statistical tests of appropriate hypotheses presented in the previous sections. A more qualitative discussion of results, conclusions, and implications is presented in the next chapter. The research answers presented at this point are only those which could be statistically supported.

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#### Research Question Number One

In which areas of the present Air Force Inspection and Readiness Evaluation System are the attitudes of operational unit managers positive?

The ADC unit managers who were surveyed showed significantly positive attitudes toward the present Air Force Inspection and Readiness Evaluation System in the areas of "relevancy" and the "general" aspects.

The SAC unit managers surveyed showed significantly positive attitudes toward the present Air Force Inspection and Readiness Evaluation System in the areas of "relevancy" and "effectiveness."

#### Research Question Number Two

In which areas of the present Air Force Inspection and Readiness Evaluation System are the attitudes of the operational unit managers negative?

Neither the ADC nor SAC unit managers surveyed showed significantly negative attitudes toward any of the areas of the present Air Force Inspection and Readiness Evaluation System.



Research Question Number Three

What is the overall attitude of the operational unit managers toward the present Air Force Inspection and Readiness Evaluation System?

The overall attitude for both the ADC and SAC unit managers surveyed was significantly positive toward the present Air Force Inspection and Readiness Evaluation System.

Research Question Number Four

Is there a significant difference between the attitudes of ADC unit managers and SAC unit managers toward the present Air Force Inspection and Readiness Evaluation System?

There was not a significant difference in the "overall" attitudes of ADC and SAC unit managers toward the present Air Force Inspection and Readiness Evaluation System. However, there was a significant difference in attitude toward two areas of the inspection and evaluation system.

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In the area of the "criticality" of inspections and evaluations, SAC unit managers displayed a significantly more positive attitude than did the ADC unit managers. The attitude of the ADC unit managers tended to be more negative, while the attitude of SAC unit managers tended to be neutral.

In the area of the "efficiency" of inspections and evaluations, ADC unit managers displayed a significantly more positive attitude than did the SAC unit managers. The

attitude of ADC unit managers tended to be positive, while the attitude of SAC unit managers tended to be negative.

## Chapter 4

### SOME QUALITATIVE INFERENCES OF THE SURVEY, SUMMARY OF FINAL CONCLUSIONS, AND IMPLICATIONS FOR FUTURE RESEARCH

The findings presented to this point in the study have been only those supportable from the quantitative analysis of the scored surveys. However, attitudes cannot be completely characterized in purely quantitative terms; nor can they be precisely defined as, or limited to, a point on a scale. Therefore, before drawing any final conclusions or discussing implications for future study, the authors present some qualitative impressions left by this research.

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#### QUALITATIVE INFERENCES

The inferences drawn by the authors from this research were influenced in two ways. First, it was gratifying to see the genuine interest in the research subject shown by the operational unit managers who were sampled. The additional comments supplied by many of the respondents were quite thoughtful and of great value in the qualitative analysis. The authors would be remiss in their duties as researchers if these two aspects of the study were not discussed.

The authors felt that a significant degree of interest was reflected in the subject of inspections and evaluations by the operational unit managers surveyed. This interest was inferred by the authors from the high percentage of completed surveys returned and the large number of additional comments included by the respondents. Ninety sample surveys were mailed to selected job positions within ADC and SAC. A date was established, due to the research timetable, such that no surveys could be included in the statistical analysis which were returned after this date. Sixty-four surveys were returned prior to the deadline and four were returned after the deadline. Only one survey was returned with a refusal to participate. The total of 68 completed surveys returned provided the authors with a participation rate of over 75 percent. Most research designs indicate that a 40 to 60 percent participation rate is the most which can be expected from impersonal (not addressed to individuals by name) surveys.<sup>1</sup> The authors inferred from this high response rate that the working level managers were highly interested in research dealing with the inspection system.

An example of the type of gratifying response which the survey received was a questionnaire returned by an ADC maintenance supervisor. In lieu of merely completing the

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<sup>1</sup>Selltiz, op. cit., p. 241.

survey himself, this officer had the survey completed by his communications-electronics maintenance officer, a Second Lieutenant with eight months experience in the field, and also by his NCO of Quality Control, a Master Sergeant with 17 years experience. He did this to provide the authors with a comparison by experience levels. The sergeant scored above the hypothesized medians in all areas and had an overall score of 126, which was significantly above the hypothesized median of 104. The lieutenant's scores were below the hypothesized medians in all areas except "efficiency" and "general." The lieutenant's overall score was 99, as compared to the hypothesized median of 104. Although no real conclusions could be drawn from only one response of this sort and this response was not received in time to be included in the quantitative analysis, it does exemplify the typically participative indulgence which the survey received from the managers in the field.

Section III of the survey provided space in which the unit managers could write additional comments about either the Air Force inspection program or the survey itself. Of the 68 surveys returned, 29, or almost one-half, had additional comments. There were over twice as many unfavorable comments as favorable concerning present inspection programs, although the scores of the surveys with additional comments were evenly divided above and below the overall median score. The authors felt that this ratio of unfavorable to favorable comments was merely a reflection of the

human tendency to verbalize more often upon the negative aspects of a subject than upon its positive aspects. However, the most recurrent comments tended to reinforce the quantitative findings of the previous chapter.

Of the favorable comments, the one expressed most often by both the ADC and SAC managers was the idea that inspections and/or evaluations of the operating activities by an outside source was both necessary and useful to them as managers. The managers felt that a yearly inspection kept them more aware of all aspects of their jobs. These comments confirmed the significantly positive scores for both ADC and SAC managers in the area of "relevancy" and in their overall attitude toward inspections and evaluations.

The most frequent unfavorable comment of the ADC managers was concerned with the fact that too often too much of the inspection or evaluation report is involved with detailed descriptions of noncompliance with administrative "technicalities." The most frequent unfavorable comment of the SAC managers was that there were too many inspections and evaluations, often occurring too close together. The SAC managers seem to feel that too many different agencies at different Air Force levels were conducting similar types of inspections. These comments seemed to have been reflected in the scores of the ADC managers tending to be lower in the area of "criticality" and the scores of the SAC managers tending to be lower in the area of "efficiency." These comments also seemed to reinforce the differences



found in the attitude scores of the managers in the two commands toward the "criticality" and "efficiency" areas.

#### SUMMARY OF FINAL CONCLUSIONS

The subject for this research effort was originally developed from a research proposal submitted to this school from an Air Force major command staff agency. A similar proposal was also submitted from the functional area of maintenance. Both original proposals, however, suggested that the attitudes of the managers at the working level were very negative toward present inspection and readiness evaluation programs. These proposals further suggested that students should undertake an evaluation of present programs with the research hypothesis being to prove present programs as ineffective, inefficient, and overly costly.

The authors decided, however, that an objective measurement of the attitudes of operational unit managers toward present inspection and evaluation programs would be a more logical point at which to initiate research on this subject. An evaluative research effort made prior to an objective attitude determination could have been based upon an inaccurate assumption as to this attitude. In fact, the results of the research presented in this study deny the existence of any overwhelmingly negative attitude of unit managers toward present inspection and evaluation programs.

### Quantitative Conclusions

The authors of this study measured the attitudes of operational unit managers in two major commands toward present Air Force Inspection and Readiness Evaluation Programs. Measurements were made both as to an "overall" attitude and as to the attitude in certain critical sub-areas. The authors concluded that the overall attitude of ADC and SAC unit managers was significantly positive toward the present system. No significantly negative attitudes were noted in any of the critical sub-areas measured. There was no significant difference in the overall attitudes of the ADC and SAC unit managers toward the inspection and readiness evaluation system, although significant differences were found in the areas of "criticality" and "efficiency."

### Combined Qualitative and Quantitative Statement of Conclusions

Overall, the objectives and implementation procedures of present Air Force Inspection and Readiness Evaluation Programs are positively accepted by operational unit managers. By and large, these managers feel that these programs are relevant to the management control and informational needs of operational activities. Although no strongly negative attitudes were noted, some "dissatisfiers" do exist. From the comments received, it is evident that most managers include "staff assistance visits" within the inspection and evaluation system. When these assistance



visits are included, the managers have a tendency to feel "overinspected." When they feel "overinspected" they feel that higher level management is not trusting them to manage their activities competently, or with any degree of deviation from normal, or for longer than a few weeks at a time without an on-site inspection. This feeling of "overinspection" causes the SAC managers to surmise that so many visits to the operating units cannot possibly be efficient in light of the time they themselves spend preparing for the visits and answering reports and in light of the travel time of the inspectors. This same feeling of "overinspection" prompts the ADC managers to surmise that many of the items examined and reported by "inspectors" (again including staff assistance people) are in areas of administrative technicalities and not critical to a unit's actual operational mission capability. These factors often lead to a "satisfactory" operational rating followed by page upon page of discrepancy items in the reports of inspections and evaluations. This causes the questioning of the "satisfactory" rating in the minds of the readers of the reports, both at the unit level and above.

A consensus statement of the attitude of these operational unit managers would seem to be the following:

Yes, we need an objective inspection and evaluation of our operational capability at least once each year. We appreciate the effect this method has upon directing our attention to the overall mission, and our unit's ability to accomplish its assigned portion of that mission. However, too many visits and too much emphasis on administrative items dilute this attention

concentrating effect. Operational factors should continue to be inspected and evaluated. However, administrative compliance details should be handled by truly "assistance" oriented visits. This would provide a needed simplification of the system and a beneficial purification of the reporting process.

### IMPLICATIONS FOR FUTURE RESEARCH

A number of future research efforts concerning the subject of the Air Force inspection system may be implied from this study. Two such efforts, however, would seem the next most logical steps in an objective, methodical analysis of the inspection system. It is cautioned that subjective evaluations based upon premature assumptions have no place in modern scientific management analysis.

One such follow-on study would be to confirm or deny the attitude findings of operating level managers which have been concluded by these authors. More powerful nonparametric statistical tests could be used on the same data collected by this study. Proceeding further along these same lines, researchers willing to assume interval scaling for this data could apply the very powerful parametric statistical tests. Following a slightly different approach, a future researcher might wish to measure the attitudes of an analogous sample population using a different type of attitude scale, such as a semantic differential scale. In any of these cases the results and conclusions of the future research could then be compared with the findings of this study.

A second follow-on approach which would be most logical would be the undertaking of a similar attitude

survey of operational managers at higher organizational levels within the Air Force. For instance, a survey of the overall attitudes and of attitudes pertaining to the critical areas defined by this study could be undertaken with a sample population of Air Force managers at the major command level. A correlation test could then be made using the scores from the major command level obtained in that study and the scores from the operational unit level obtained in this study. With information available as to positive and negative aspects of the inspection system at both levels, an objective evaluation of the inspection system could be made which could include precise factual suggestions for improvements and refinements to the system.

APPENDIX A  
SURVEY INSTRUMENT

60

DEPARTMENT OF THE AIR FORCE  
AIR FORCE INSTITUTE OF TECHNOLOGY (AU)  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

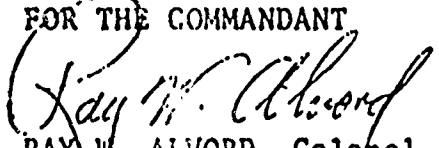


REPLY TO  
ATTN OF SLGR/SLSR -72A/Maj Kestler/Autovon 797-7769

SUBJECT Inspection System Attitude Survey

1. The attached questionnaire has been developed to collect data which will be used in the conduct of a thesis by two of the graduate students of the School of Systems and Logistics. The purpose of this research is to provide information for evaluating the attitudes of managers in the Aerospace Defense Command toward the present Air Force Inspection and Readiness Evaluation System.
2. As a matter of convenience, the information requested is to be entered on the attached questionnaire. There has been no attempt made to identify specific individuals completing the questionnaire. Please complete all items as requested. You are, of course, free to add any comments which you may wish to provide. HQ USAF Survey Control Number HQ 72-24 has been assigned to this questionnaire. However, completion of the questionnaire is voluntary.
3. A pre-addressed envelope is enclosed for your convenience in returning the questionnaire. It is requested that the questionnaire be returned within one week of receipt.
4. Thank you for your willingness to contribute to this study.

FOR THE COMMANDANT

  
RAY W. ALVORD, Colonel, USAF  
Deputy Dean  
School of Systems and Logistics

2 Atch  
1. Questionnaire  
2. Envelope

## SECTION I

Please complete each of the following:

1. Present duty AFSC \_\_\_\_\_
2. Present grade \_\_\_\_\_
3. Grade of present UDL position \_\_\_\_\_
4. Level of assignment (Div Hq, Wg, Grp, Sqd, etc.) \_\_\_\_\_
5. Present job title \_\_\_\_\_
6. Length of time present job or similar job held \_\_\_\_\_

## SECTION II

Directions: On the following pages are statements concerning your feelings toward selected areas of the Air Force Inspection and Readiness Evaluation System. Read each statement carefully and then indicate the degree to which you agree or disagree with it by drawing a circle around the letter(s) which best represents your attitude. Please respond to each statement.

SA - STRONGLY AGREE

I strongly agree with the statement.

A - AGREE

I agree with the statement, but not so strongly.

TA - TEND TO AGREE

I agree with the statement, but only partially.

N - NEUTRAL

I cannot agree or disagree with the statement.

TD - TEND TO DISAGREE

I disagree with the statement, but only partially.

D - DISAGREE

I disagree with the statement, but not so strongly.

SD - STRONGLY DISAGREE

I strongly disagree with the statement.

SA STRONGLY AGREE	A AGREE	TA TEND TO AGREE	N NEUTRAL	TD TEND TO DISAGREE	D DISAGREE	SD STRONGLY DISAGREE
1. Information in inspection reports on my unit is a significant aid in evaluating degree of accomplishment of my assigned mission.						
					SA	A T N TD D SD
2. The information in inspection reports on other units is a significant aid in improving my management methods.						
					SA	A T N TD D SD
3. Inspections identify deficient management practices.						
					SA	A T N TD D SD
4. Inspections and evaluations identify the causes of deficient management practices.						
					SA	A T N TD D SD
5. Inspections and evaluation findings provide facts upon which corrective actions should be based.						
					SA	A T N TD D SD
6. I feel that inspection and evaluation provides a valid measure of my units ability.						
					SA	A T N TD D SD
7. Inspection ground rules are such that they are easily adapted to the mission peculiar to my unit.						
					SA	A T N TD D SD
8. Problems existing prior to the inspection should be brought to the attention of the inspection team.						
					SA	A T N TD D SD
9. Coordination at higher levels tends to keep overinspection and inspection overlap and duplication at a minimum.						
					SA	A T N TD D SD
10. The time spent preparing for and undergoing inspections and evaluations is not detrimental to unit mission accomplishment.						
					SA	A T N TD D SD
11. The time spent in replying to inspection reports is time well spent.						
					SA	A T N TD D SD
12. Inspection report format indicates clearly the deficiencies of my unit and requires no further interpretation of regulations and manuals.						
					SA	A T N TD D SD
13. Outstanding management practices are often written-up so other units can benefit from these practices.						
					SA	A T N TD D SD

SA STRONGLY AGREE	A AGREE	TA TEND TO AGREE	N NEUTRAL	TD TEND TO DISAGREE	D DISAGREE	SD STRONGLY DISAGREE
-------------------------	------------	------------------------	--------------	---------------------------	---------------	----------------------------

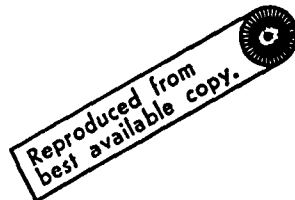
14. Inspection and evaluation teams attempt to concentrate on areas critical to the assigned mission rather than on less critical areas. SA A TA N TD D SD
15. Inspections and evaluations are normally conducted quickly and efficiently, so as to cause as little detraction from daily activities as possible. SA A TA N TD D SD
16. The inspectors are generally well qualified and experienced in their areas of assignment. SA A TA N TD D SD
17. The augmentees assigned to large evaluations do not degrade the quality of the inspection. SA A TA N TD D SD
18. Operational units are evaluated against current operating standards. SA A TA N TD D SD
19. When asked to provide augmentation for inspection teams, I send my most qualified personnel whenever possible. SA A TA N TD D SD
20. Unit morale does not suffer because of the numbers of inspections and evaluations required yearly. SA A TA N TD D SD
21. I find it easy to get my people motivated for inspections and evaluations. SA A TA N TD D SD
22. The primary purpose of inspections is not the insuring of detailed compliance with regulations and directives. SA A TA N TD D SD
23. The objective of the inspection and evaluation system is the gathering of factual, relevant information upon which management action by myself and higher authority are based. SA A TA N TD D SD
24. The findings resulting from inspections and evaluations are factual, objective and impartial. SA A TA N TD D SD
25. The most critical deficiencies "those which will require my most immediate attention" are readily identifiable when the findings are presented in the inspection and evaluation reports. SA A TA N TD D SD
26. The inspection and evaluation system has adapted to the changing operational environment. SA A TA N TD D SD



## SECTION III

Directions: This section is provided so that you may add any additional information about the present Air Force Inspection and Readiness Evaluation System you feel was not adequately covered by the preceding statements.

Favorable Aspects:



Unfavorable Aspects:

APPENDIX B

DISTRIBUTION OF RESPONSES TO EACH  
SURVEY STATEMENT

## INTRODUCTION

This appendix contains, in the form of histograms, a graphic representation of the responses to each of the questions contained in the survey instrument. Questions are grouped into the six areas; relevancy, criticality, effectiveness, efficiency, flexibility, and general; evaluated in the thesis. Responses from Strategic Air Command (SAC) and Aerospace Defense Command (ADC) have been displayed separately to allow for visual comparisons.

Key:

SAC

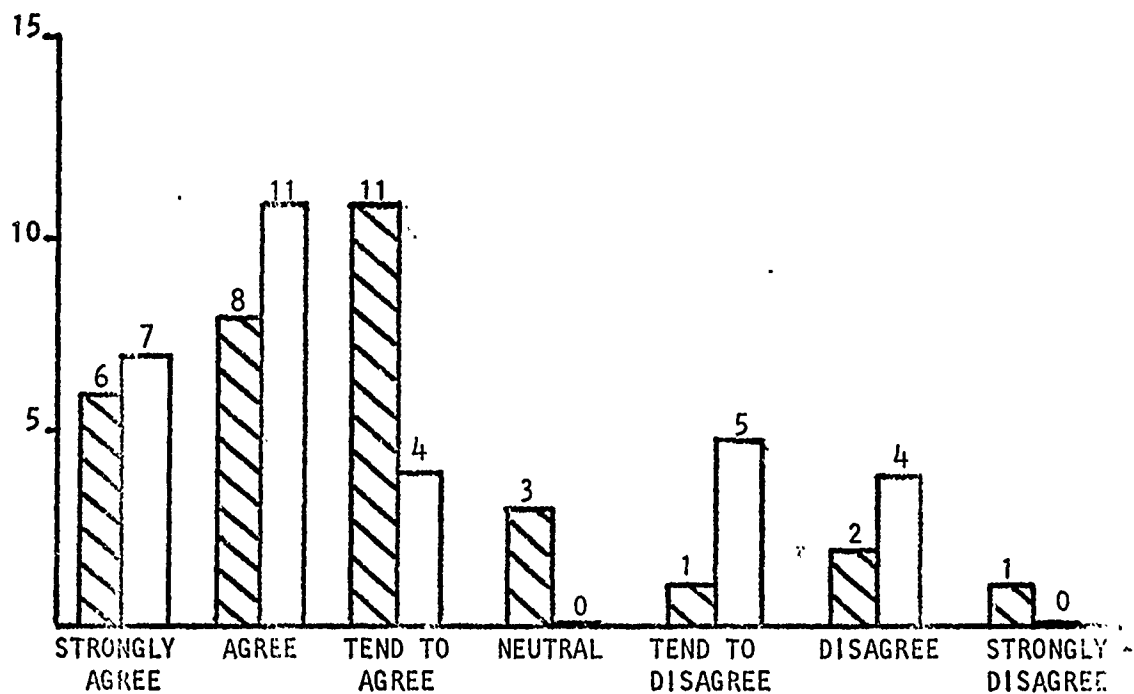
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ADC



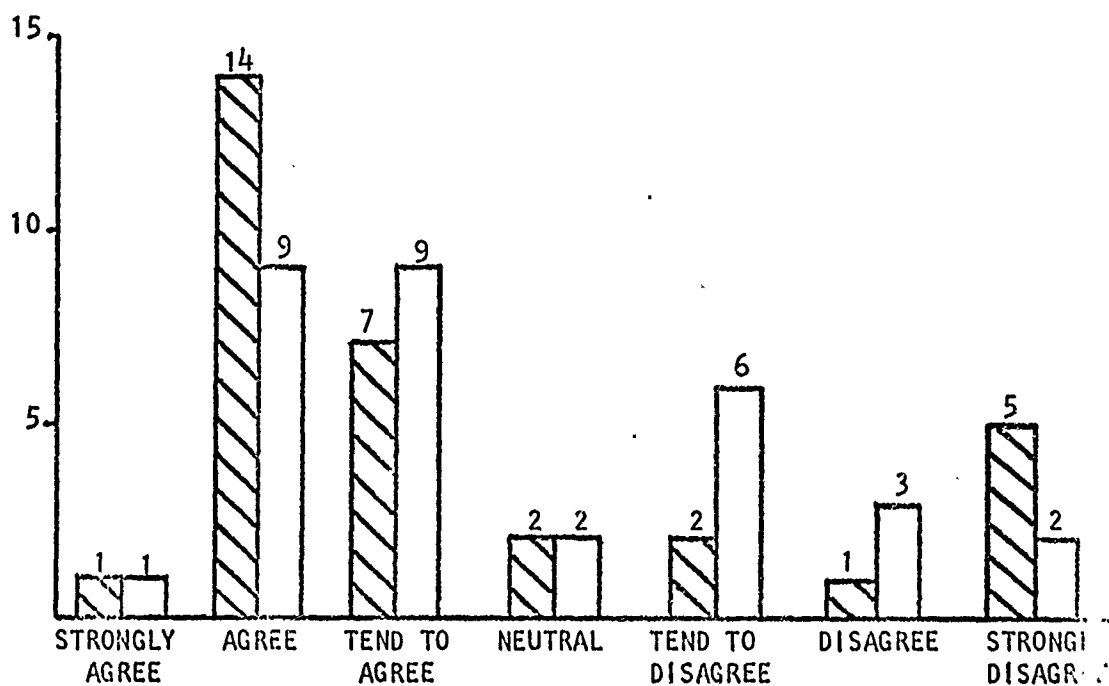
1. Information in inspection reports on my unit is a significant aid in evaluating the degree of accomplishment of my assigned mission.

no. of responses



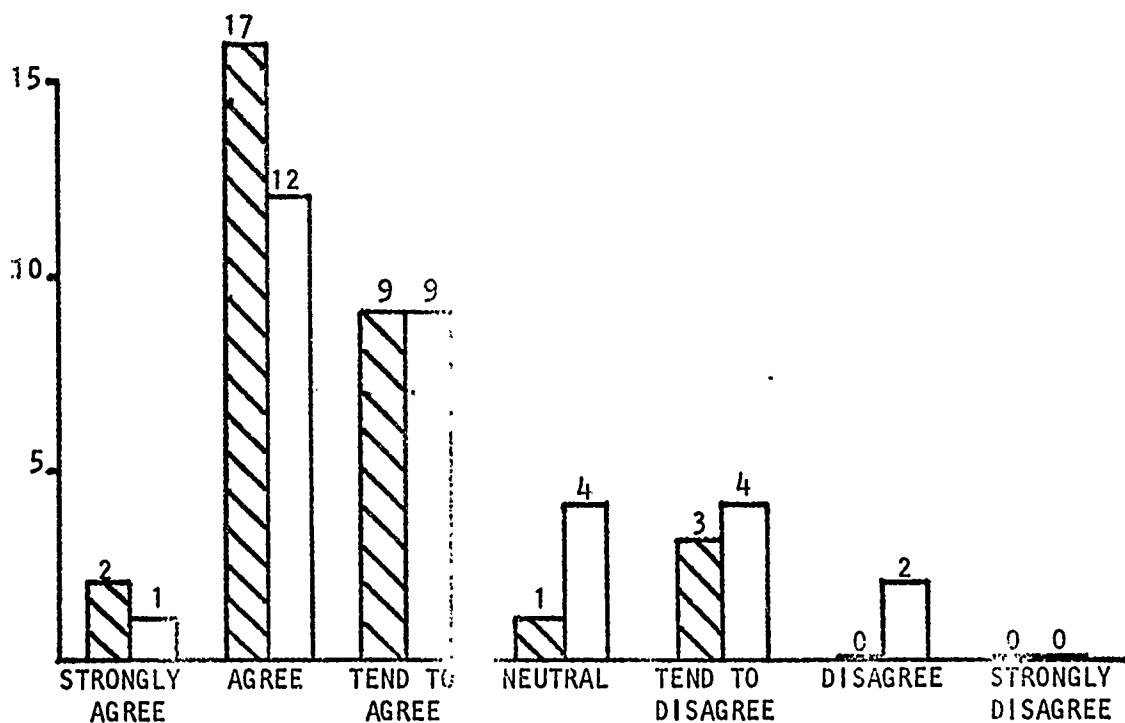
7. Inspection ground rules are such that they are easily adapted to the mission peculiar to my unit.

no. of responses



18. Operational units are evaluated against current operating standards.

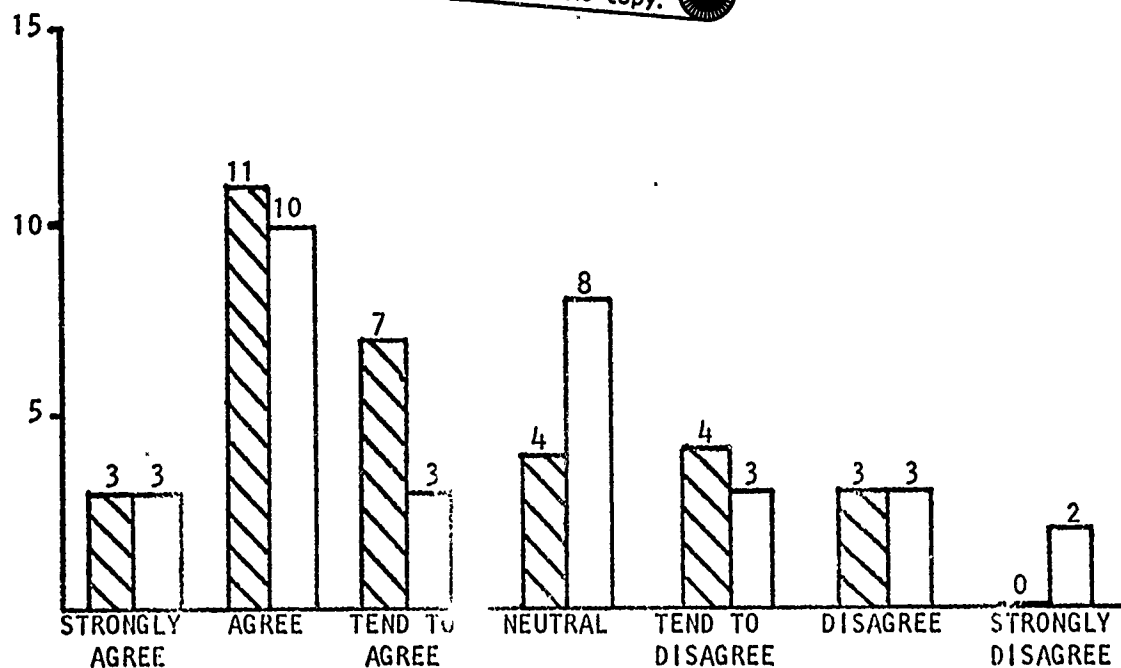
no. of responses



23. The objective of the inspection and evaluation system is the gathering of factual, relevant information upon which management action by myself and higher authority are based.

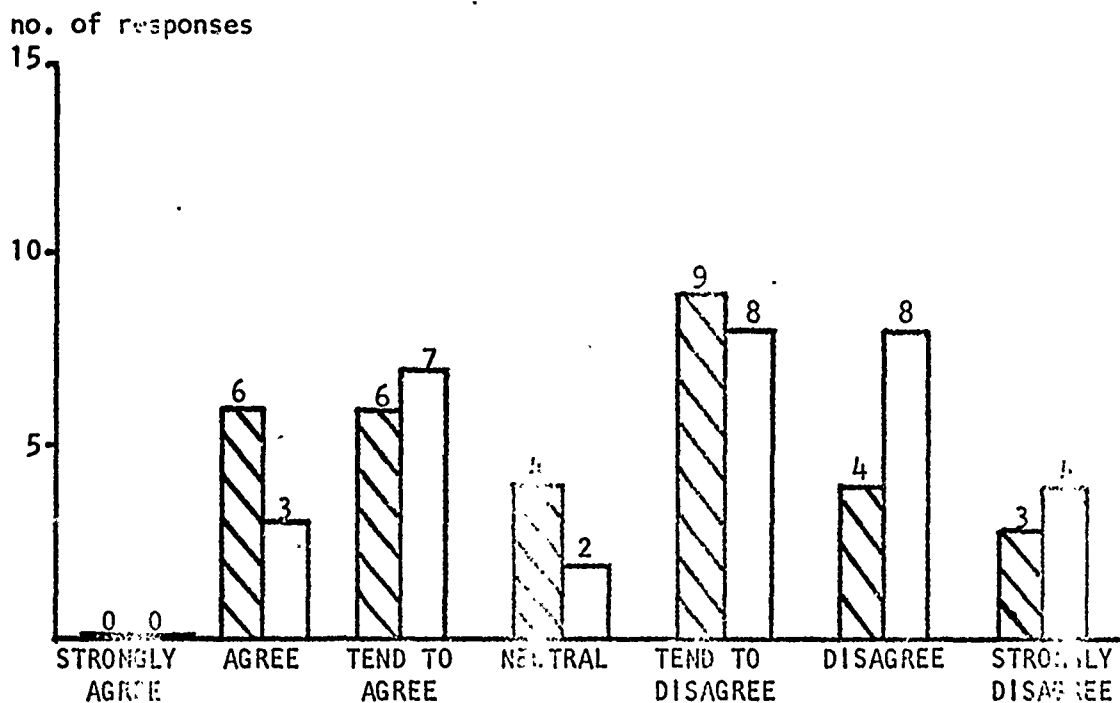
no. of responses

Reproduced from  
best available copy.

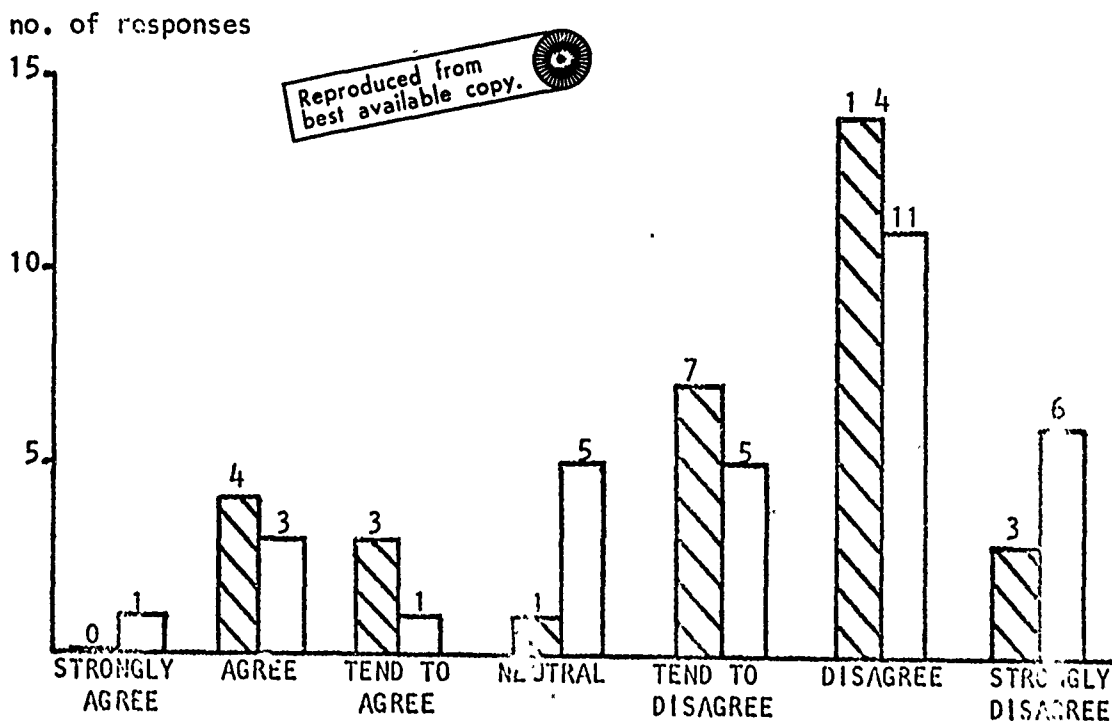


## CRITICALITY

14. Inspection and evaluation teams attempt to concentrate on areas critical to the assigned mission rather than on less critical areas.

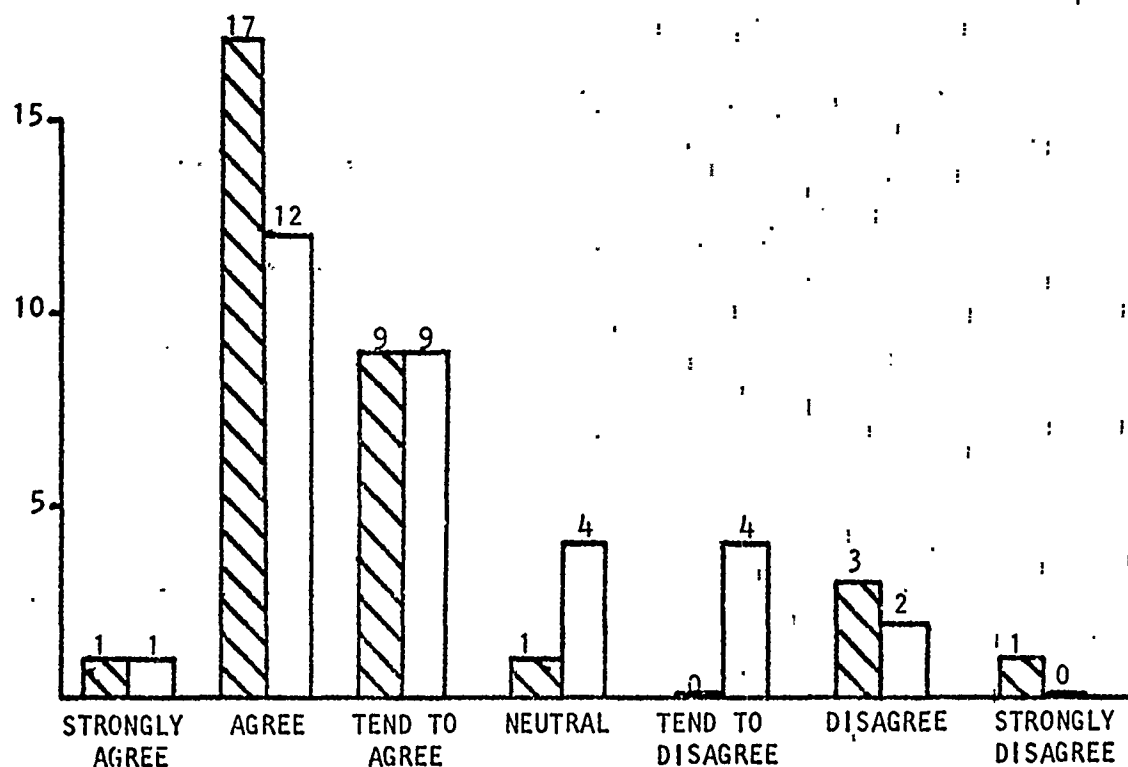


22. The primary purpose of inspections is not the insuring of detailed compliance with regulations and directives.

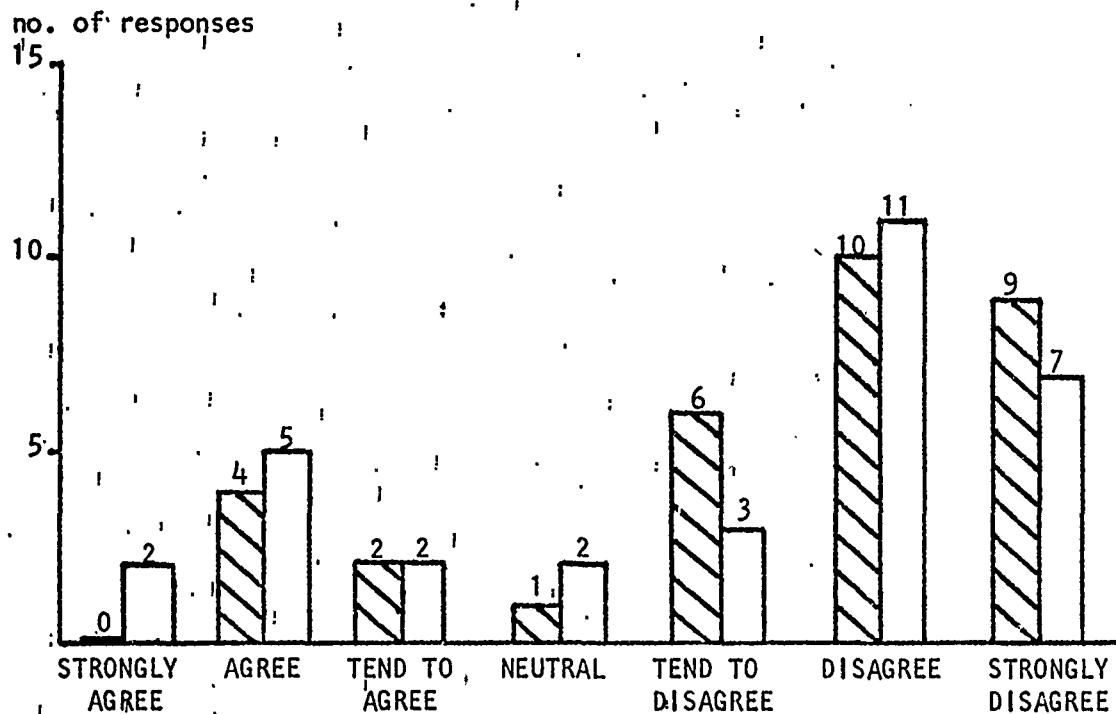


25. The most critical deficiencies "those which will require my most immediate attention" are readily identifiable when the findings are presented in the inspection and evaluation reports.

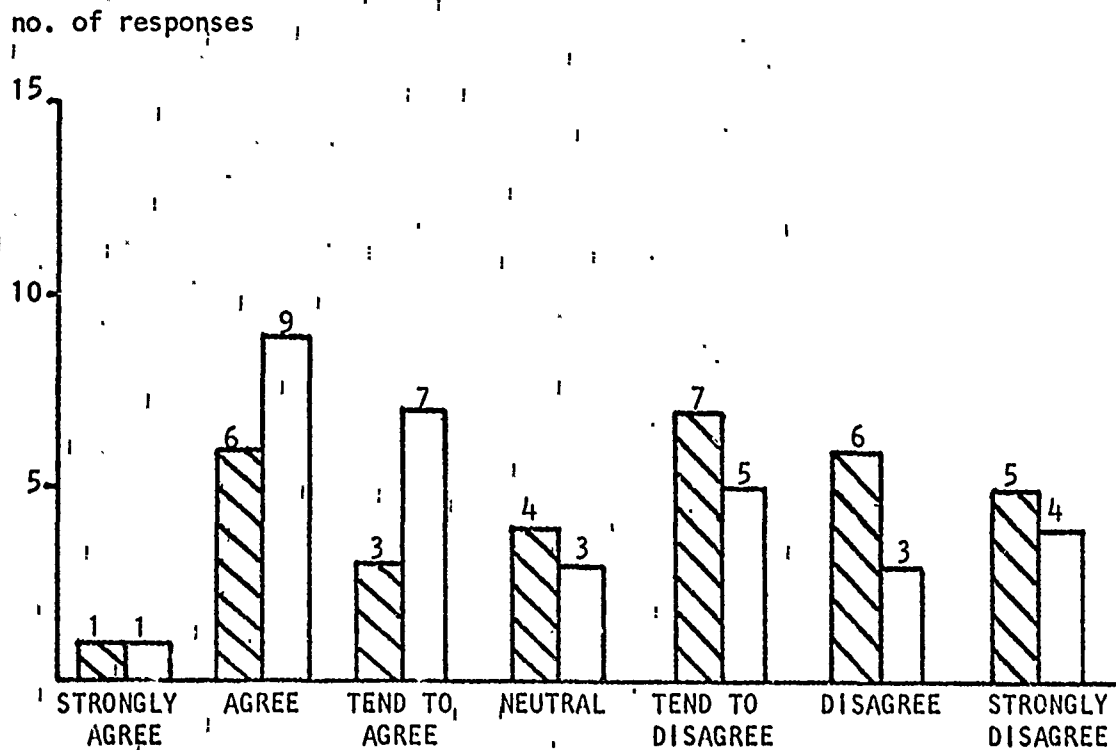
no. of responses



9. Coordination at higher levels tends to keep overinspection and inspection overlap and duplication at a minimum.



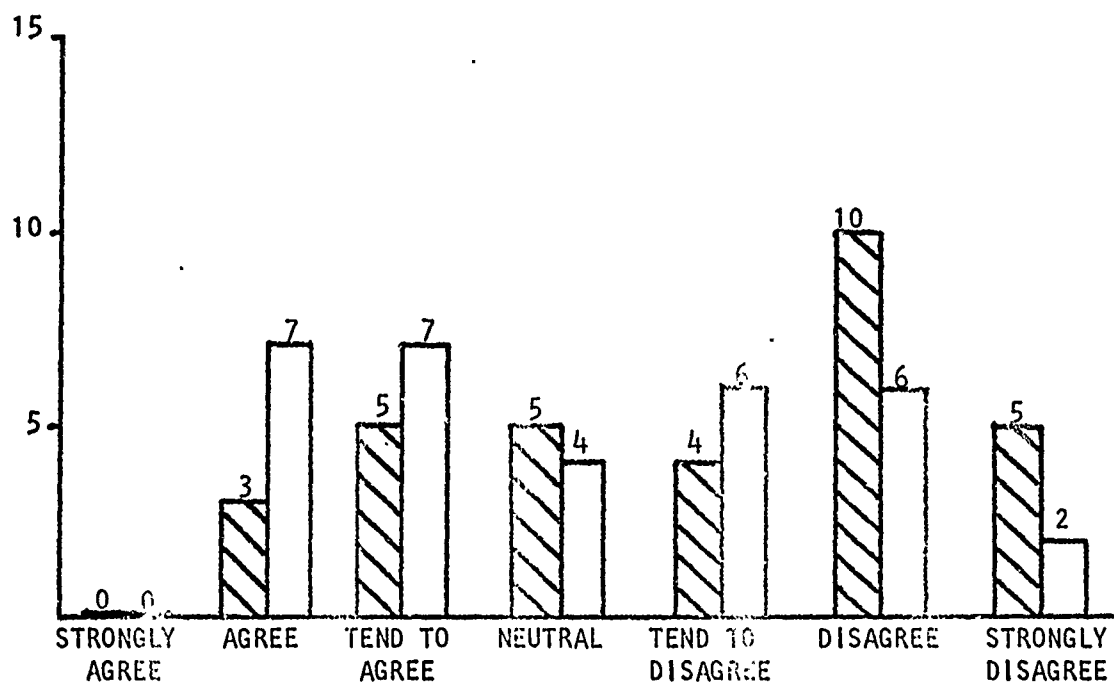
10. The time spent preparing for and undergoing inspections and evaluations is not detrimental to unit mission accomplishment.





11. The time spent in replying to inspection reports is time well spent.

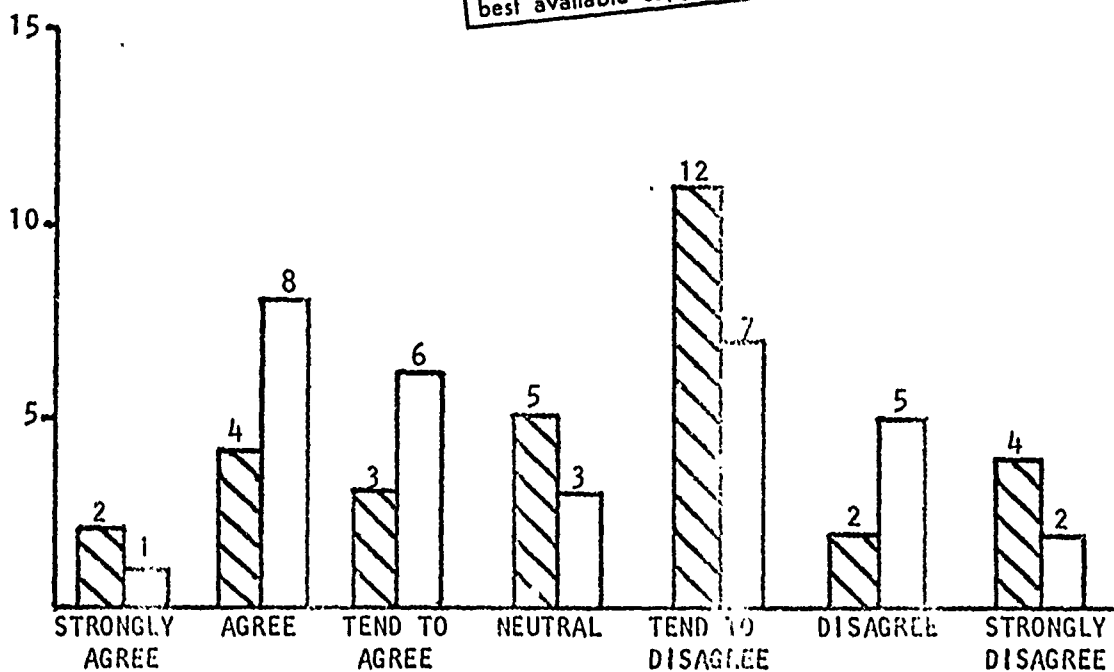
no. of responses



13. Outstanding management practices are often written-up so other units can benefit from these practices.

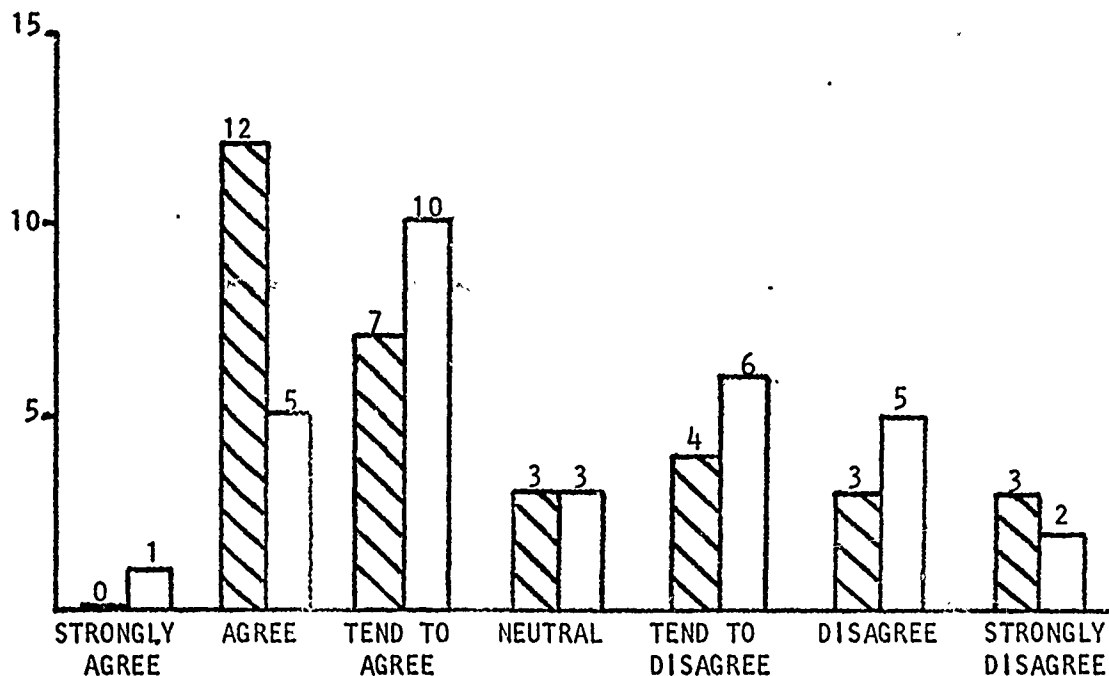
no. of responses

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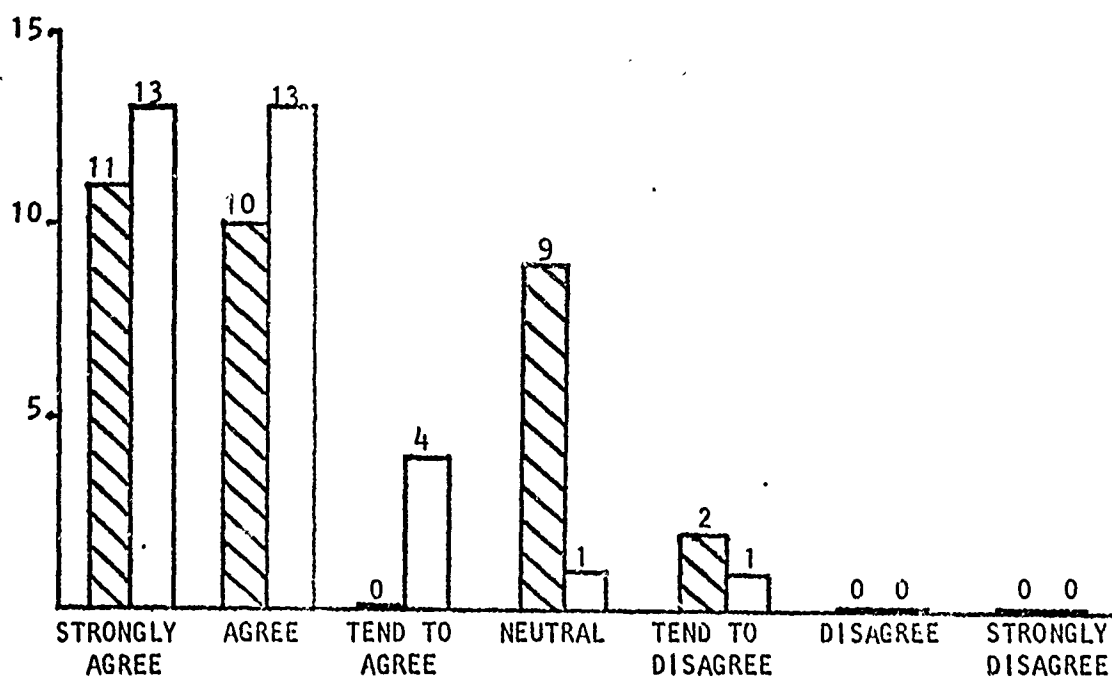
15. Inspections and evaluations are normally conducted quickly and efficiently, so as to cause as little detraction from daily activities as possible.

no. of responses



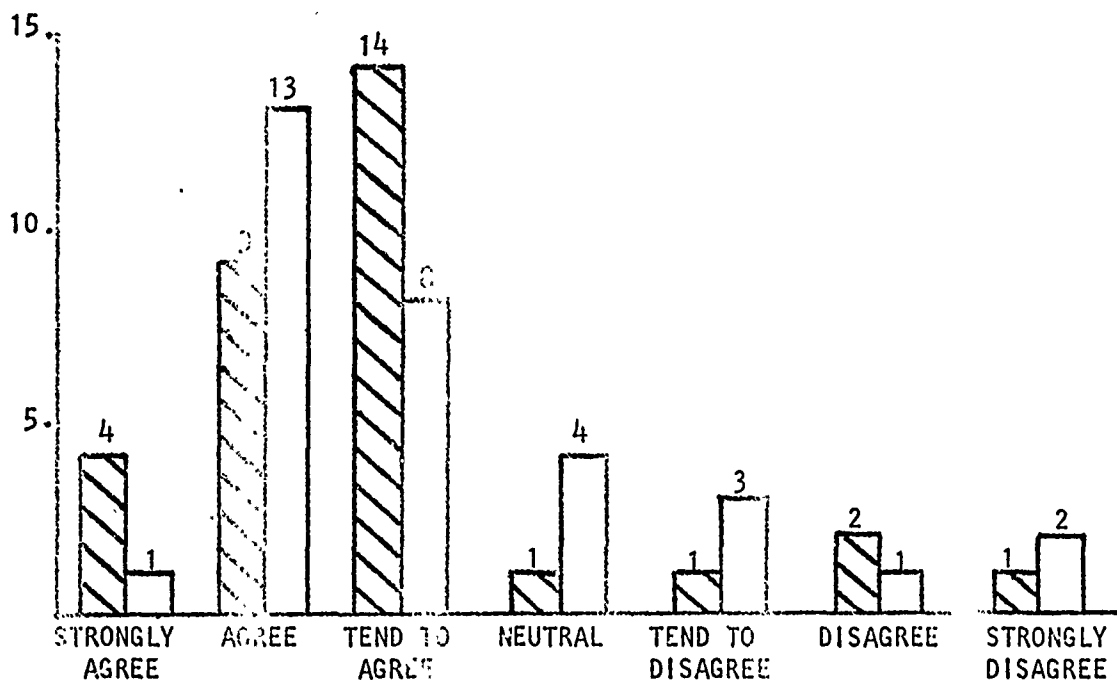
19. When asked to provide augmentation for inspection teams, I send my most qualified personnel whenever possible.

no. of responses



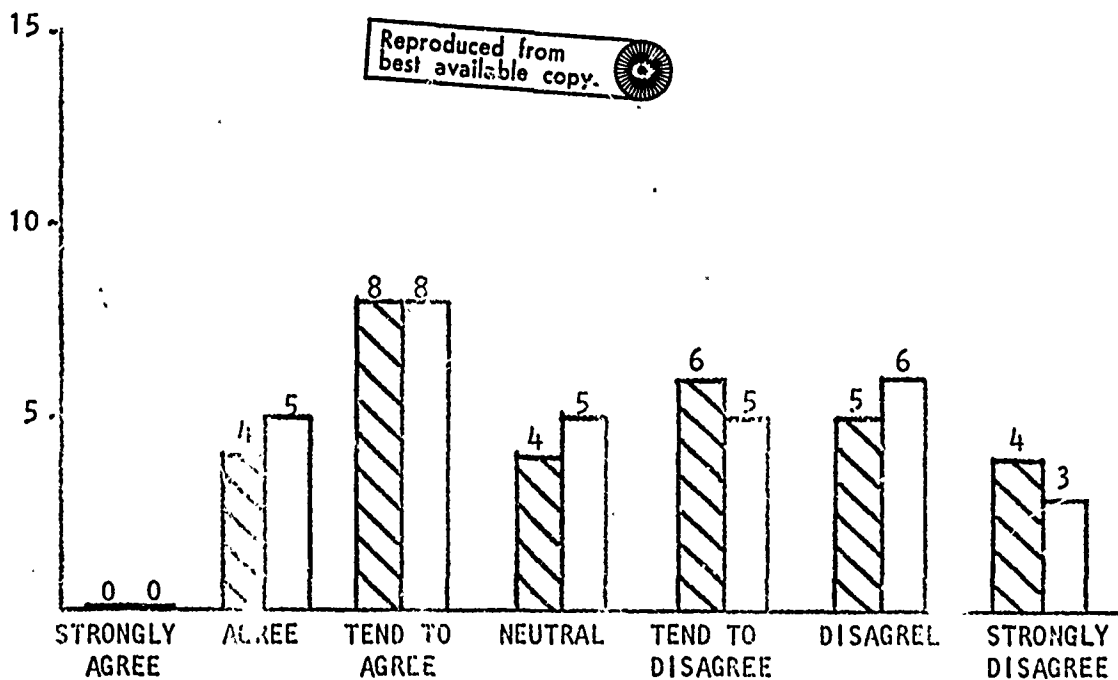
3. Inspections identify deficient management practices.

no. of responses



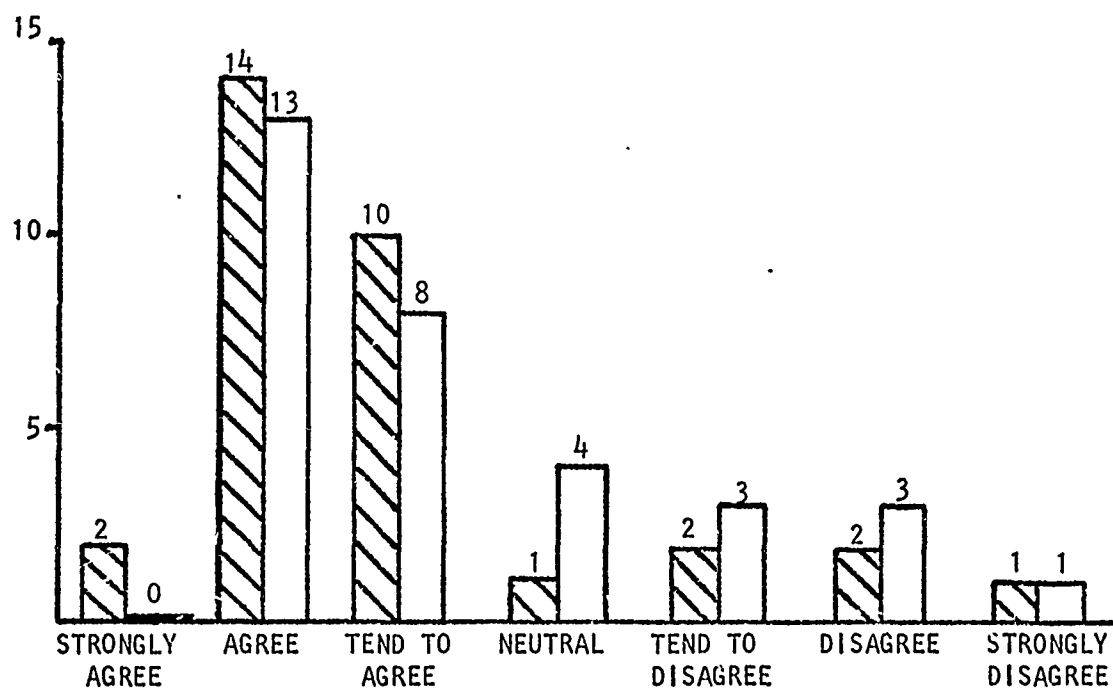
4. Inspections and evaluations identify the causes of deficient management practices.

no. of responses



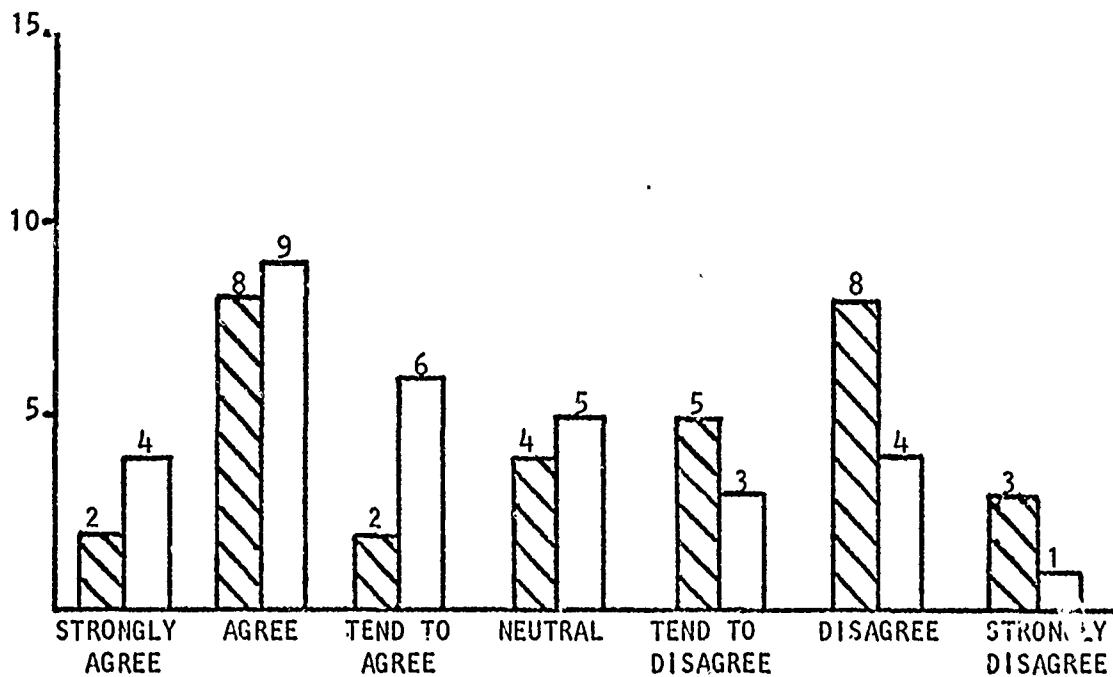
5. Inspections and evaluation findings provide facts upon which corrective actions should be based.

no. of responses



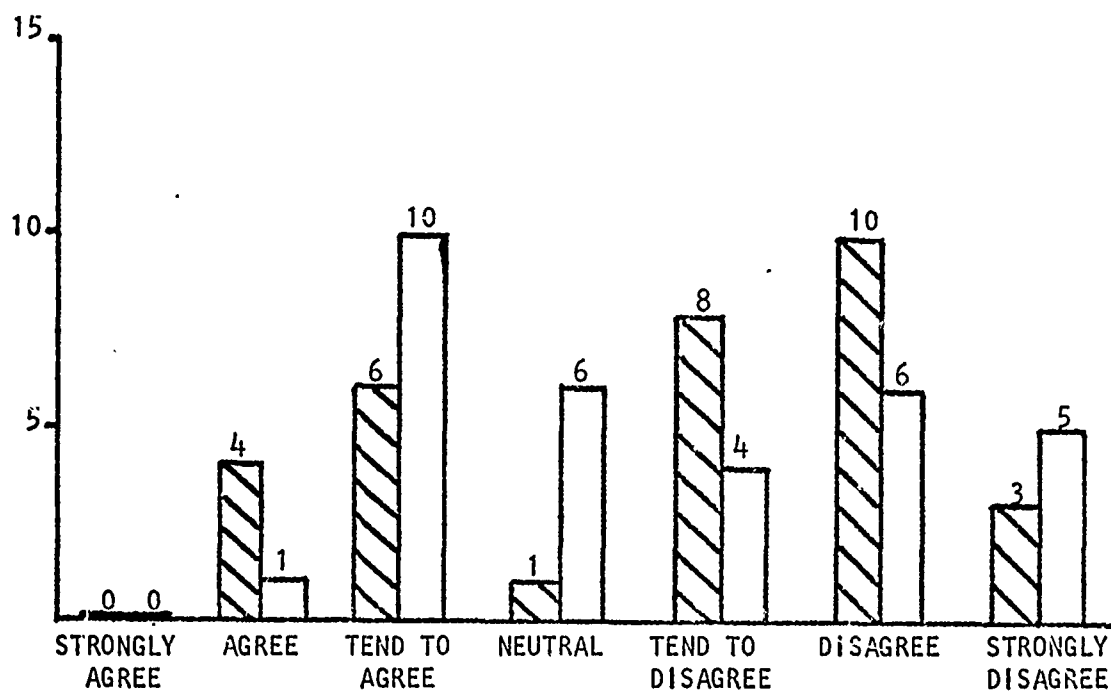
8. Problems existing prior to the inspection should be brought to the attention of the inspection team.

no. of responses



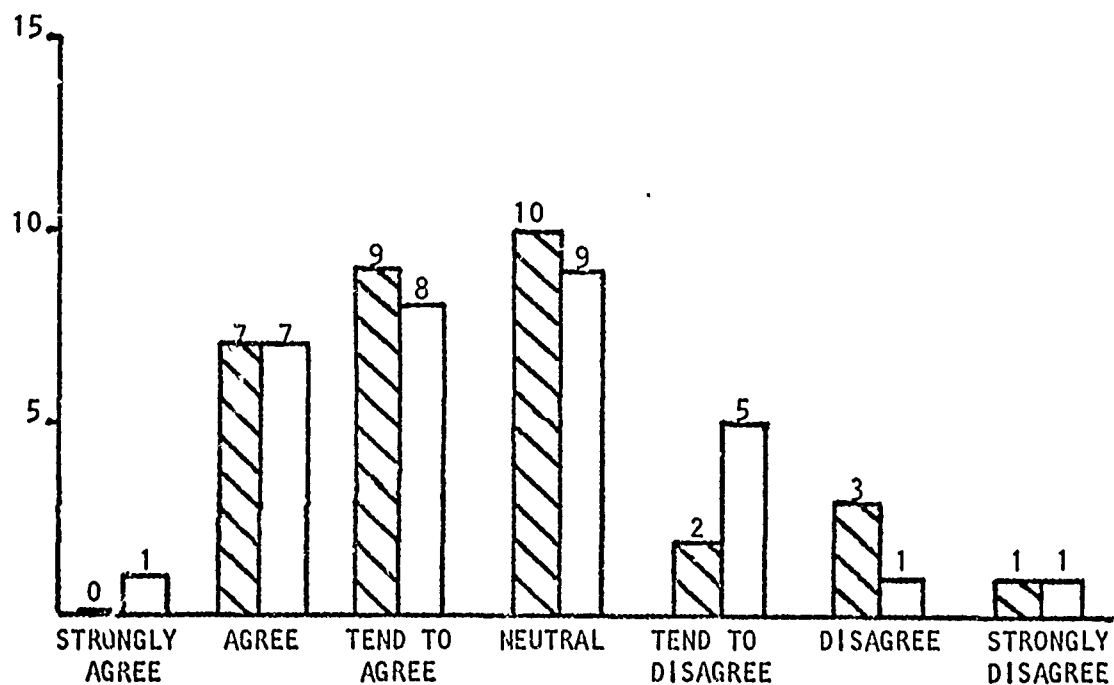
12. Inspection report format indicates clearly the deficiencies of my unit and requires no further interpretation of regulations and manuals.

no. of responses



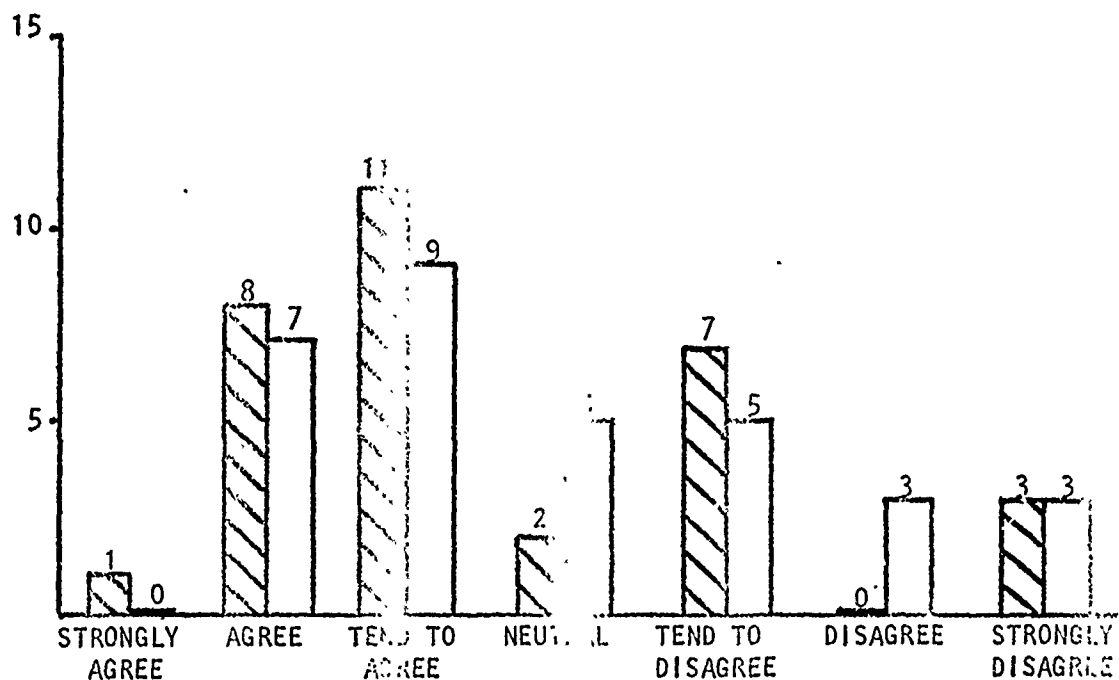
17. The augmentees assigned to large evaluations do not degrade the quality of the inspection.

no. of responses



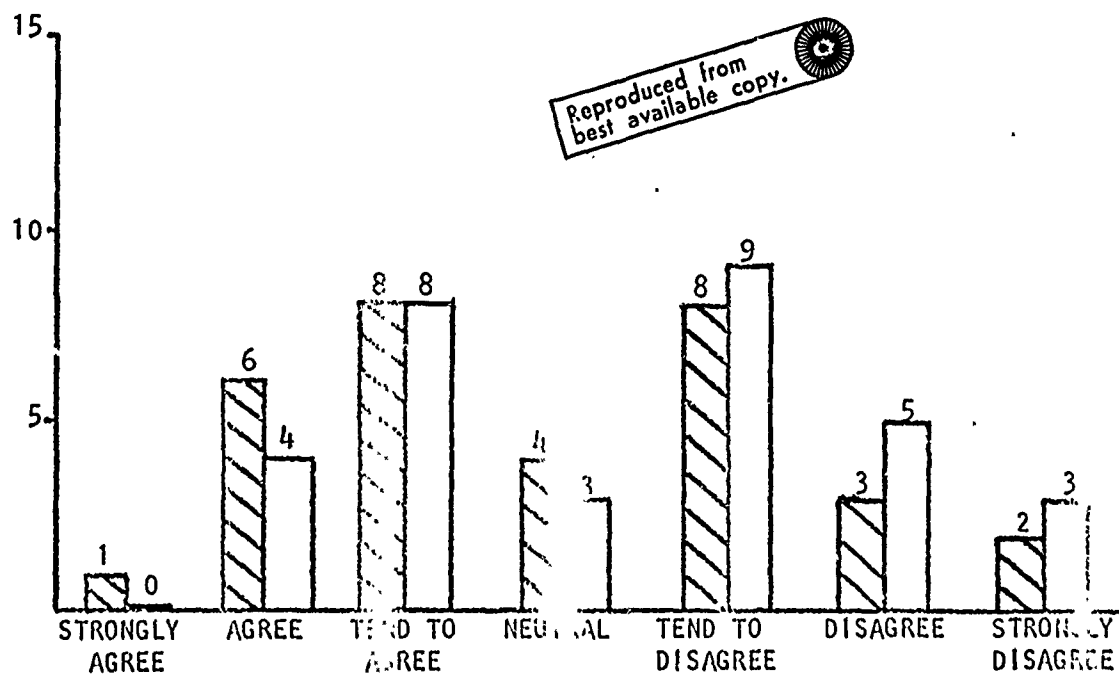
6. I feel that inspection and evaluation provides a valid measure of my units ability.

no. of responses



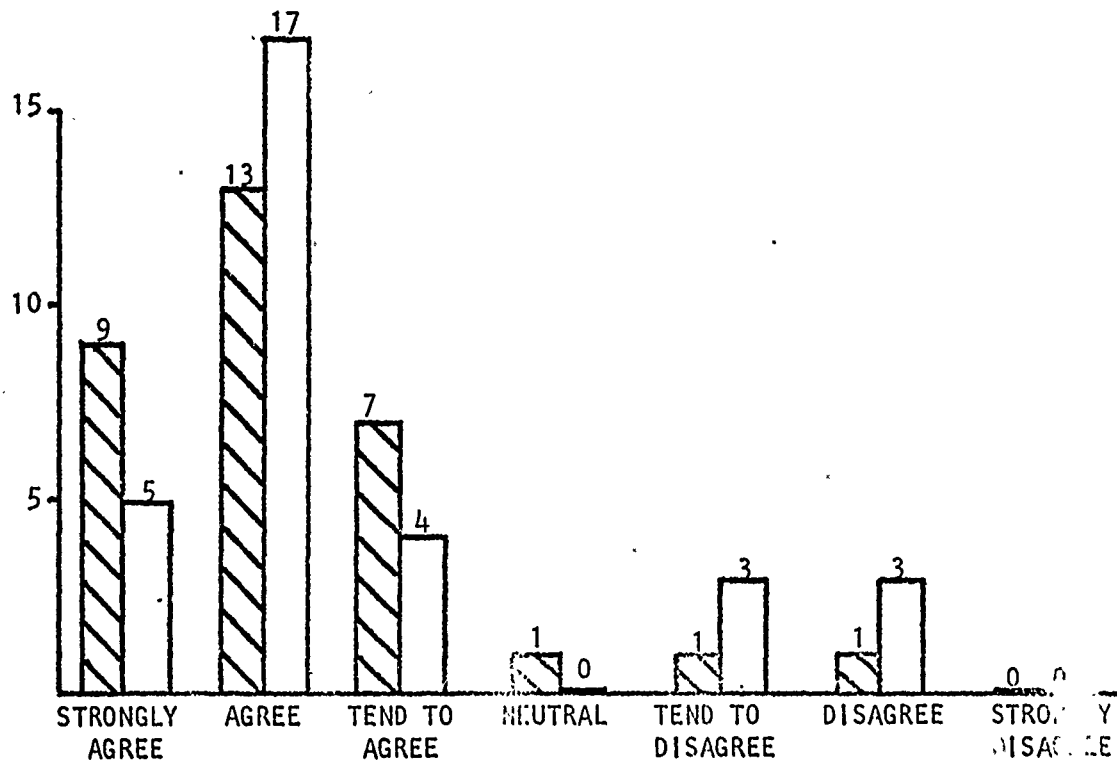
26. The inspection and evaluation system has adapted to the changing operational environment.

no. of responses



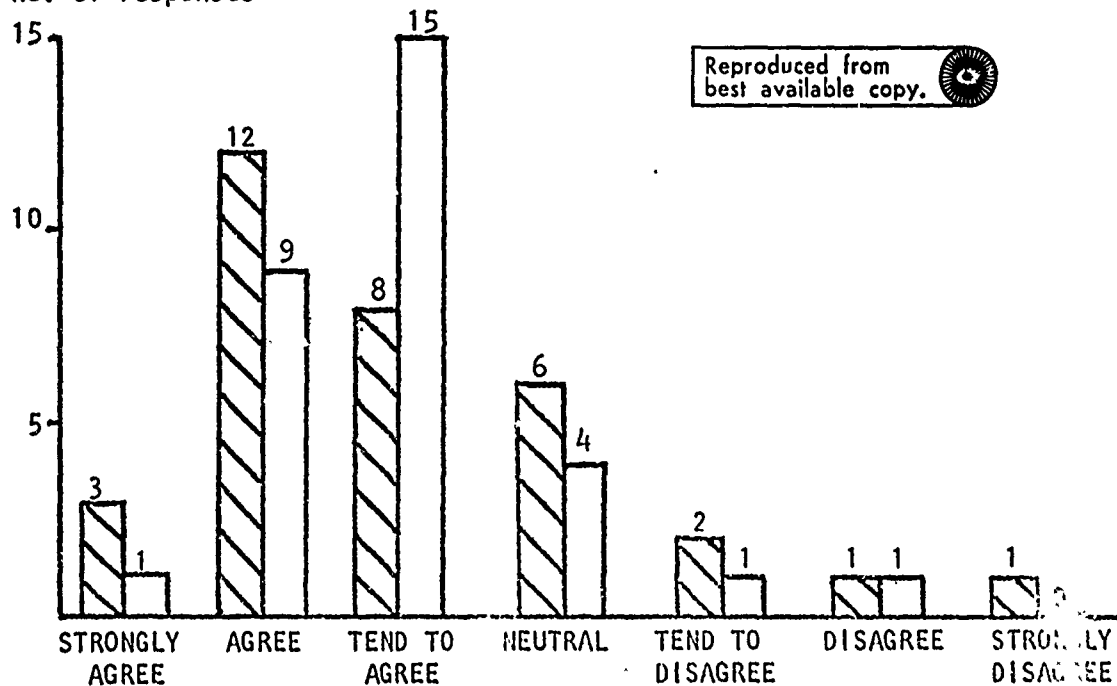
2. The information in inspection reports on other units is a significant aid in improving my management methods.

no. of responses



16. The inspectors are generally well qualified and experienced in their areas of assignment.

no. of responses

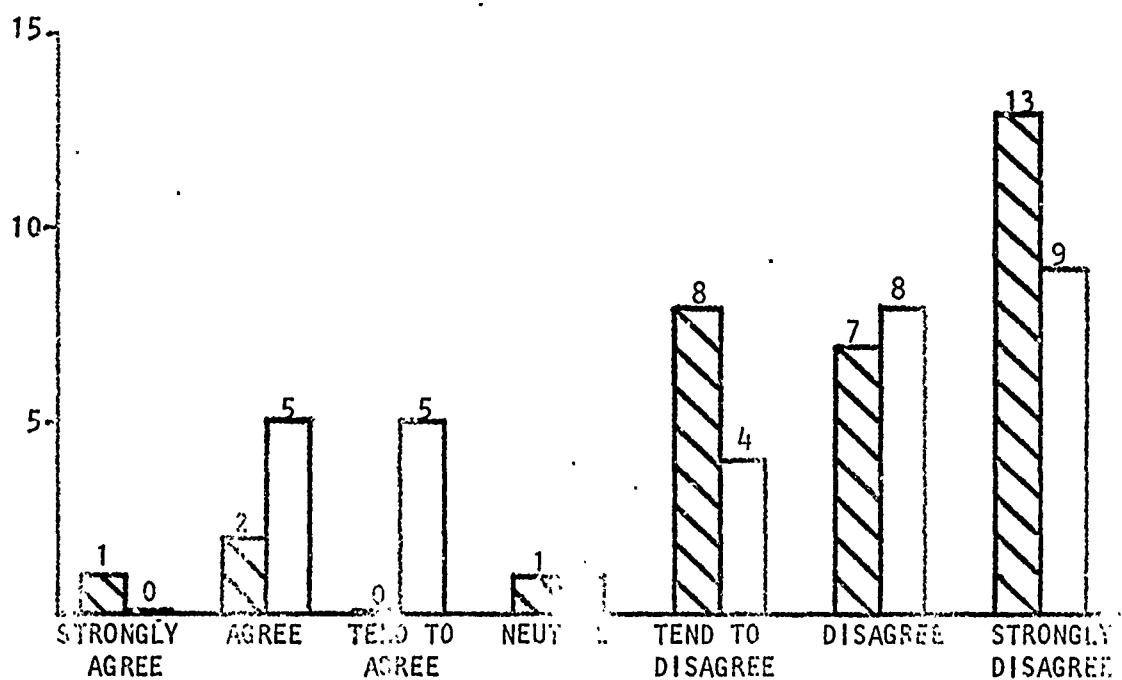


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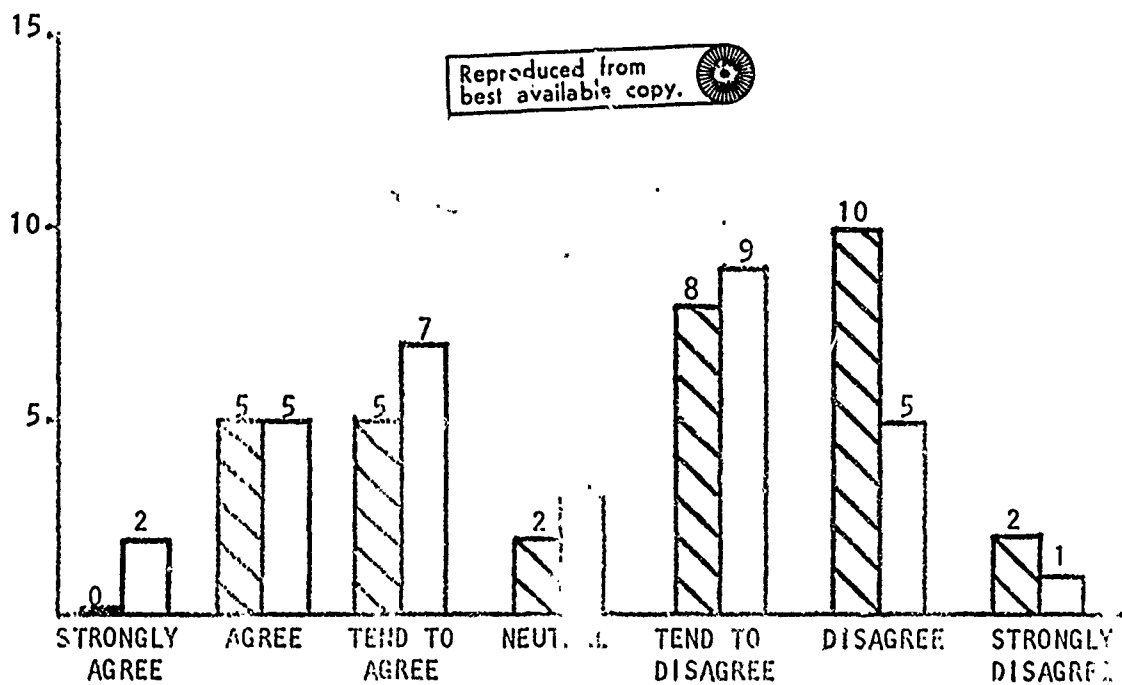
20. Unit morale does not suffer because of the numbers of inspections and evaluations required yearly.

no. of responses



21. I find it easy to get my people motivated for inspections and evaluations.

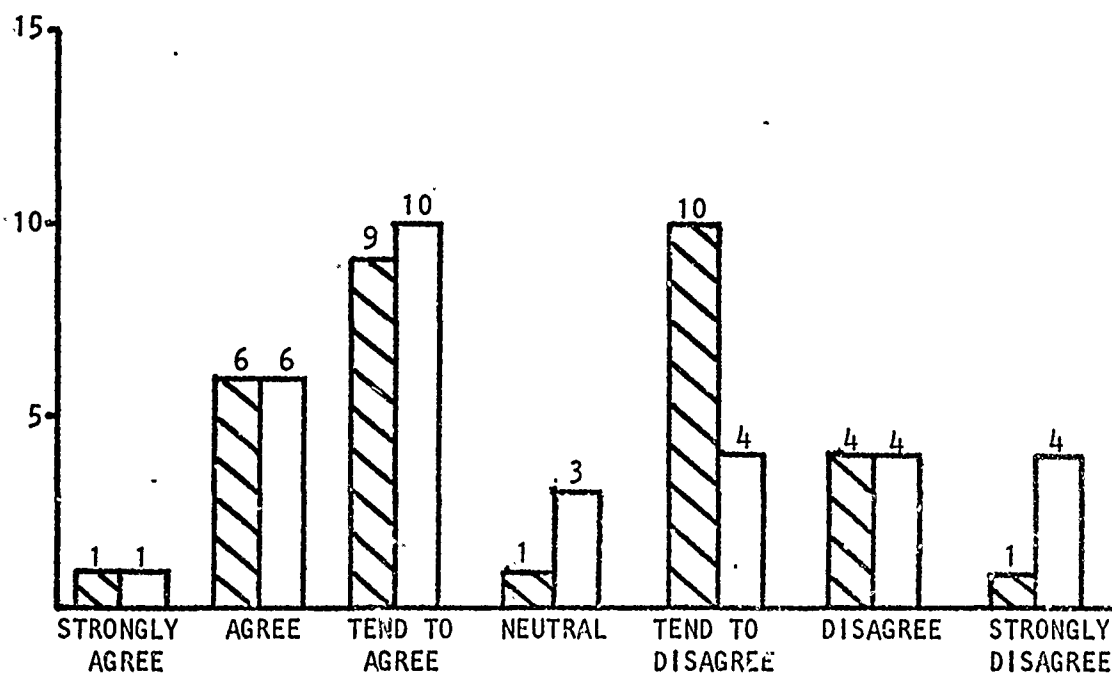
no. of responses





24. The findings resulting from inspections and evaluations are factual, objective and impartial.

no. of responses



## AEROSPACE DEFENSE COMMAND RAW SCORES

Relevancy	Criticality	Effectiveness	Efficiency	Flexibility	General	Total
9	6	14	14	2	15	60
19	13	28	25	12	21	118
22	11	30	18	9	24	114
17	11	17	24	7	20	96
19	14	26	30	10	25	124
13	6	23	21	7	22	92
16	11	33	30	8	23	121
24	16	34	26	10	26	136
19	10	25	25	9	25	113
11	7	20	17	6	15	76
24	10	30	21	9	19	113
23	10	31	33	7	25	129
7	6	15	16	3	9	56
22	11	24	25	5	22	109
14	10	14	28	4	15	85
17	13	24	23	2	20	99
24	14	34	32	11	23	138
21	16	27	32	7	22	125
23	10	28	27	8	22	118
12	7	12	23	6	13	73
21	11	28	30	8	21	119
23	14	33	34	12	29	145
23	14	34	32	8	30	141
19	13	22	18	12	20	104
23	10	30	29	8	29	129
22	7	27	27	6	23	112
24	15	37	30	11	28	145
12	11	22	23	7	15	90
25	14	28	34	11	26	138
19	14	26	25	9	20	113
16	9	13	22	5	12	77
19	10	24	32	9	24	118

## STRATEGIC AIR COMMAND RAW SCORES

Relevancy	Criticality	Effectiveness	Efficiency	Flexibility	General	Total
14	10	19	22	6	16	87
26	14	34	32	13	25	144
24	11	28	28	8	21	120
15	5	10	14	6	14	64
22	17	21	19	8	23	110
24	7	22	25	8	20	106
10	8	14	19	2	15	68
20	14	19	24	11	22	110
19	11	23	26	7	21	107
20	17	24	19	8	21	109
23	12	24	26	10	20	115
19	11	24	22	9	19	104
20	13	24	28	10	21	116
23	12	18	32	12	23	120
25	12	30	26	11	26	130
21	13	22	26	7	17	106
15	12	17	29	5	21	99
20	16	29	29	11	24	129
21	14	25	29	8	20	117
23	13	28	28	11	25	128
15	12	17	20	8	16	88
19	8	13	22	8	17	87
24	16	23	36	11	22	132
21	11	21	21	8	20	102
21	12	25	25	10	18	111
23	14	30	26	12	28	133
17	6	16	28	3	14	84
24	12	31	30	13	32	142
21	14	28	27	5	33	128
15	10	17	17	7	18	84
16	10	23	25	7	14	95
23	14	33	29	11	22	132

APPENDIX C

RAW DATA AND STATISTICAL CALCULATIONS

## Research Questions 1, 2, and 3

Relevancy Scores ADC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 16

x = random variable, number of scores above = 23  
y = random variable, number of scores below = 7  
N = 30

 $H_0$ : Median  $\leq$  16 $H_1$ : Median  $>$  16

Level of significance = .05

Required probability:  $P(y \leq 7 | H_0)$ Binomial probability ( $p = .5$ ,  $N = 30$ ) = .0026Conclusion: .0026  $<$  .05, therefore, reject  $H_0$ , accept  $H_1$

## Research Questions 1, 2, and 3

Criticality Scores ADC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 12

x = random variable, number of scores above = 12

y = random variable, number of scores below = 20

N = 32

 $H_0$ : Median  $\geq 12$  $H_1$ : Median  $< 12$ 

Level of significance = .05

Required probability:  $P(x \leq 12 | H_0)$ Binomial probability ( $p = .5$ ,  $N=32$ ) = .1077Conclusion:  $.1077 > .05$ , therefore, cannot reject  $H_0$

## Research Questions 1, 2, and 3

Efficiency Scores ADC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 24

x = random variable, number of scores above = 19

y = random variable, number of scores below = 10

N = 29

 $H_0$ : Median  $\leq$  24 $H_1$ : Median  $>$  24

Level of significance = .05

Required probability:  $P(y \leq 10 | H_0)$ Binomial probability ( $p = .5$ ,  $N = 29$ ) = .0680Conclusion: .0680  $>$  .05, therefore, cannot reject  $H_0$

## Research Questions 1, 2, and 3

Effectiveness Scores ADC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 24

x = random variable, number of scores above = 20  
y = random variable, number of scores below = 11  
N = 31

 $H_0$ : Median  $\leq$  24 $H_1$ : Median  $>$  24

Level of significance = .05

Required probability:  $P(y \leq 11 | H_0)$ Binomial probability ( $p = .5$ ,  $N = 31$ ) = .0748Conclusion: .0748  $>$  .05, therefore, cannot reject  $H_0$



## Research Questions 1, 2, and 3

Flexibility Scores ADC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 8

$x$  = random variable, number of scores above = 13  
 $y$  = random variable, number of scores below = 14  
 $N$  = 27

 $H_0$ : Median = 8 $H_1$ : Median  $\neq$  8Level of significance =  $.05/2 = .025$ Required probability:  $P(x \leq 13 | H_0)$ Binomial probability ( $p = .5$ ,  $N = 27$ ) = .4999Conclusion:  $.4999 > .025$ , therefore, cannot reject  $H_0$

## Research Questions 1, 2, and 3

General Scores ADC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 20

x = random variable, number of scores above = 20  
y = random variable, number of scores below = 8  
N = 28

 $H_0$ : Median  $\leq$  20 $H_1$ : Median  $>$  20

Level of significance = .05

Required probability:  $P(y \leq 8 | H_0)$ Binomial probability ( $p = .5$ ,  $N = 28$ ) = .0178Conclusion:  $.0178 < .05$ , therefore, reject  $H_0$ , accept  $H_1$

## Research Questions 1, 2, and 3

Overall Scores ADC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 104

x = random variable, number of scores above = 21  
y = random variable, number of scores below = 10  
N = 31

 $H_0$ : Median  $\leq$  104 $H_1$ : Median  $>$  104

Level of significance = .05

Required probability:  $P(y \leq 10 | H_0)$ Binomial probability ( $p = .5$ ,  $N = 31$ ) = .0354Conclusion:  $.0354 < .05$ , therefore, reject  $H_0$ , accept  $H_1$

## Research Questions 1, 2, and 3

Relevancy Scores SAC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 16

$x$  = random variable, number of scores above 16 = 25  
 $y$  = random variable, number of scores below 16 = 6  
 $N = 31$

 $H_0$ : Median  $\leq 16$  $H_1$ : Median  $> 16$ 

Level of significance = .05

Required probability:  $P(y \leq 6 | H_0)$ Binomial probability ( $p = .5$ ,  $N = 31$ ) = .0004Conclusion: .0004 < .05, therefore, reject  $H_0$ , accept  $H_1$

## Research Questions 1, 2, and 3

Criticality Scores SAC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 12

$x$  = random variable, number of scores above = 13  
 $y$  = random variable, number of scores below = 12  
 $N$  = 25

 $H_0$ : Median = 12 $H_1$ : Median  $\neq$  12Level of significance =  $.05/2 = .025$ Required probability:  $P(y \leq 12 | H_0)$ Binomial probability ( $p = .5, N = 25$ ) = .4999Conclusion:  $.4999 > .025$ , therefore, cannot reject  $H_0$

## Research Questions 1, 2, and 3

Efficiency Scores SAC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 24

$x$  = random variable, number of scores above = 11  
 $y$  = random variable, number of scores below = 17  
N = 28

$$H_0: \text{Median} \geq 24$$

$$H_1: \text{Median} < 24$$

Level of significance = .05

Required probability:  $P(x \leq 11 | H_0)$ Binomial probability ( $p = .5$ ,  $N = 28$ ) = .1725Conclusion:  $.1725 > .05$ , therefore, cannot reject  $H_0$

## Research Questions 1, 2, and 3

Effectiveness Scores SAC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 24

x = random variable, number of scores above = 21  
y = random variable, number of scores below = 10  
N = 31

 $H_0$ : Median  $\leq$  24 $H_1$ : Median  $>$  24

Level of significance = .05

Required probability:  $P(y \leq 10 | H_0)$ Binomial probability ( $p = .5$ ,  $N = 31$ ) = .0354Conclusion: .0354  $<$  .05, therefore, reject  $H_0$ , accept  $H_1$

## Research Questions 1, 2, and 3

Flexibility Scores SAC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 8

x = random variable, number of scores above = 12  
y = random variable, number of scores below = 10  
N = 24

 $H_0$ : Median  $\leq 8$  $H_1$ : Median  $> 8$ 

Level of significance = .05

Required probability:  $P(y \leq 10 | H_0)$ Binomial probability ( $p = .5$ ,  $N = 24$ ) = .2706Conclusion: .2706  $>$  .05, therefore, cannot reject  $H_0$



## Research Questions 1, 2, and 3

General Scores SAC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 20

x = random variable, number of scores above = 17  
y = random variable, number of scores below = 11  
N = 28

 $H_0$ : Median  $\leq 20$  $H_1$ : Median  $> 20$ 

Level of significance = .05

Required probability:  $P(y \leq 11 | H_0)$ Binomial probability ( $p = .5$ ,  $N = 28$ ) = .1725Conclusion: .1725  $>$  .05, therefore, cannot reject  $H_0$

## Research Questions 1, 2, and 3

Overall Scores SAC Survey

Test used: Sign Test

Given: Hypothesized median score (neutral) = 104

$x$  = random variable, number of scores above = 21  
 $y$  = random variable, number of scores below = 10  
 $N = 31$

 $H_0$ : Median  $\leq 104$  $H_1$ : Median  $> 104$ 

Level of significance = .05

Required probability:  $P(y \leq 10 | H_0)$ Binomial probability ( $p = .5, N = 31$ ) = .0354Conclusion:  $.0354 < .05$ , therefore, reject  $H_0$ , accept  $H_1$

## Research Question 4

Relevancy

Test used: Median Test

Median Relevancy score for combined sample = 20.5

Number equal to median and dropped from sample = 0

Contingency Table

	ADC	SAC	
Above median	15	17	32
Below median	17	15	32
	32	32	N = 64

 $H_0$ : Median (ADC)  $\geq$  Median (SAC) $H_1$ : Median (ADC)  $<$  Median (SAC)

Level of Significance = .10 (one-tailed test)

Degrees of freedom (df) = 1

$$\text{Chi Square} = \frac{N(AD - BC - N/2)^2}{(A + B)(C + D)(A + C)(B + D)}$$

$$= .0625$$

 $.0625 < 2.71$  (Chi Square critical)Therefore, cannot reject  $H_0$ .

## Research Question 4

Criticality

Test used: Median Test

Median Criticality score for combined sample = 11.5

Number equal to median and dropped from sample = 0

Contingency Table

	ADC	SAC	
Above median	12	20	32
Below median	20	12	32
	32	32	N = 64

 $H_0$ : Median (ADC)  $\geq$  Median (SAC) $H_1$ : Median (ADC) < Median (SAC)

Level of Significance = .10 (one-tailed test)

Degrees of freedom (df) = 1

$$\text{Chi Square} = \frac{N(AD - BC - N/2)^2}{(A + B)(C + D)(A + C)(B + D)}$$

$$= 3.06$$

3.06 &gt; 2.71 (Chi Square critical)

Therefore, reject  $H_0$ .

## Research Question 4

Efficiency

Test used: Median Test

Median Efficiency score for combined sample = 24

Number equal to median and dropped from sample = 7

## Contingency Table

	ADC	SAC	
Above median	19	11	30
Below median	10	17	27
	29	28	N = 57

 $H_0$ : Median (ADC)  $\leq$  Median (SAC) $H_1$ : Median (ADC)  $>$  Median (SAC)

Level of Significance = .10 (one-tailed test)

Degrees of freedom (df) = 1

$$\text{Chi Square} = \frac{N(AD - BC - N/2)^2}{(A + B)(C + D)(A + C)(B + D)}$$

$$= 2.97$$

2.97  $>$  2.71 (Chi Square critical)Therefore, reject  $H_0$ .

## Research Question 4

Effectiveness

Test used: Median Test

Median Effectiveness score for combined sample = 26

Number equal to median and dropped from sample = 6

Contingency Table

	ADC	SAC	
Above median	15	13	28
Below median	16	14	30
	31	27	N = 58

 $H_0$ : Median (ADC)  $\geq$  Median (SAC) $H_1$ : Median (ADC)  $<$  Median (SAC)

Level of Significance = .10 (one-tailed test)

Degrees of freedom (df) = 1

$$\text{Chi Square} = \frac{H(AD - BC - N/2)^2}{(A + B)(C + D)(A + C)(B + D)}$$

$$= .06$$

.06 &lt; 2.71 (Chi Square critical)

Therefore, cannot reject  $H_0$ .

## Research Question 4

Flexibility

Test used: Median Test

Median Flexibility score for combined sample = 8

Number equal to median and dropped from sample = 13

Contingency Table

	ADC	SAC	
Above median	13	14	27
Below median	14	10	24
	27	24	N = 51

 $H_0$ : Median (ADC)  $\geq$  Median (SAC) $H_1$ : Median (ADC)  $<$  Median (SAC)

Level of Significance = .10 (one-tailed test)

Degrees of freedom (df) = 1

$$\text{Chi Square} = \frac{N(AD - BC - N/2)^2}{(A + B)(C + D)(A + C)(B + D)}$$

$$= .20$$

.20  $<$  2.71 (Chi Square critical)Therefore, cannot reject  $H_0$ .

## Research Question 4

General

Test used: Median Test

Median General score for combined sample = 21

Number equal to median and dropped from sample = 7

Contingency Table .

	ADC	SAC	
Above median	18	12	30
Below median	12	15	27
	30	27	N = 57

 $H_0$ : Median (ADC)  $\leq$  Median (SAC) $H_1$ : Median (ADC)  $>$  Median (SAC)

Level of Significance = .10 (one-tailed test)

Degrees of freedom (df) = 1

$$\text{Chi Square} = \frac{N(AD - BC - N/2)^2}{(A + B)(C + D)(A + C)(B + D)}$$

$$= .83$$

 $.83 < 2.71$  (Chi Square critical)Therefore, cannot reject  $H_0$ .



## Research Question 4

Overall

Test used: Median Test

Median Overall score for combined sample = 113

Number equal to median and dropped from sample = 3

Contingency Table

	ADC	SAC	
Above median	16	14	30
Below median	13	18	31
	29	32	N = 61

 $H_0$ : Median (ADC)  $\leq$  Median (SAC) $H_1$ : Median (ADC)  $>$  Median (SAC)

Level of Significance = .10 (one-tailed test)

Degrees of freedom (df) = 1

$$\text{Chi Square} = \frac{N(AD - BC - N/2)^2}{(A + B)(C + D)(A + C)(B + D)}$$

$$= .41$$

 $.41 < 2.71$  (Chi Square critical)Therefore, cannot reject  $H_0$ .

APPENDIX D  
COMPUTER PROGRAMS

## COMPUTER PROGRAM USED TO CALCULATE BINOMIAL PROBABILITY

```
50 READ: SN, X
PROB = 0
IF(SN.EQ.0)GO TO 60
10 IF(X-(SN-X))3,5,5
3 XNUM = SN-X
GO TO 25
5 XNUM = X
25 DNOM = 0
PROD = 1
30 XNUM = XNUM + 1
DNOM = DNOM + 1
PROD = PROD*XNUM/DNOM
IF(XNUM-SN)30,20,20
20 TEMP = PROD*(.5**X)*( .5**(SN-X))
X = X - 1
PROB = PROB + TEMP
IF(X.GT.0)GO TO 10
100 FORMAT(F10.8)
PRINT 100, PROB
GO TO 50
60 STOP
END
```

## COMPUTER PROGRAM USED TO CALCULATE CHI SQUARE STATISTIC

10 READ: A, B, C, D

N = A + B + C + D

IF(A.EQ.0)GO TO 20

X = N\*((ABS(A\*D-B\*C)-N/2)\*\*2)

Y = ((A+B)\*(C+D))\*((A+C)\*(B+D))

CHISQ = X/Y

100 FORMAT(F12.6)

PRINT 100, CHISQ

GO TO 10

20 STOP

END

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BIOGRAPHICAL SKETCH



## BIOGRAPHICAL SKETCH

Major Joseph D. Kestler is a native of Walden, New York. He entered the Air Force as an Aviation Cadet in 1957 and was commissioned a Second Lieutenant in October 1958 upon the completion of navigator training. Major Kestler received his undergraduate degree from Park College in December 1968 under operation bootstrap. Prior to his assignment to AFIT he was assigned to the Aerospace Defense Command as a navigator, weapons systems officer, and weapons controller. His next assignment is to Cam Ranh Bay, Vietnam.

Captain Glenn E. Boren is a native of Birmingham, Alabama. He received his commission through Air Force Officer Training School in 1967. Captain Boren holds a Bachelor of Science degree in chemistry from the University of Alabama. Prior to his assignment to AFIT Captain Boren was a weapons controller with the Aerospace Defense Command. His next assignment is to the Air Force Munitions School at Lowry Air Force Base, Colorado.

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